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(12) **United States Patent**
Gronvall et al.

(10) **Patent No.: US 8,213,761 B2**
(45) **Date of Patent: Jul. 3, 2012**

(54) **MINI DROP TERMINAL**

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(73) Assignee: **ADC Telecommunications**, Eden Prairie, MN (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **12/955,701**

(22) Filed: **Nov. 29, 2010**

(65) **Prior Publication Data**

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Related U.S. Application Data

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(60) Provisional application No. 60/978,638, filed on Oct. 9, 2007.

(51) **Int. Cl.**
G02B 6/00 (2006.01)
G02B 6/36 (2006.01)

(52) **U.S. Cl.** **385/135**; 385/76; 385/77; 385/139

(58) **Field of Classification Search** 385/76, 385/77, 134–137, 139

See application file for complete search history.

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(57) **ABSTRACT**

A terminal for mounting to a fiber distribution cable includes a housing having a base and a cover. The cover is connectedly engaged with the base. The terminal further includes a plurality of adapters disposed on the cover. A fiber routing tray having a top panel and a bottom panel is disposed in an interior cavity. The fiber routing tray includes a storage space defined between the top and bottom panels for storing a length of optical fiber. A method for installing a terminal includes providing a terminal having a housing defining an interior cavity. A cable is pulled from the interior cavity of the housing. The cable is spliced to a fiber distribution cable with a splice. The cable is inserted back into the interior cavity. A spliced end of the cable, a spliced end of the fiber distribution cable and the splice are inserted in a retention device.

10 Claims, 24 Drawing Sheets

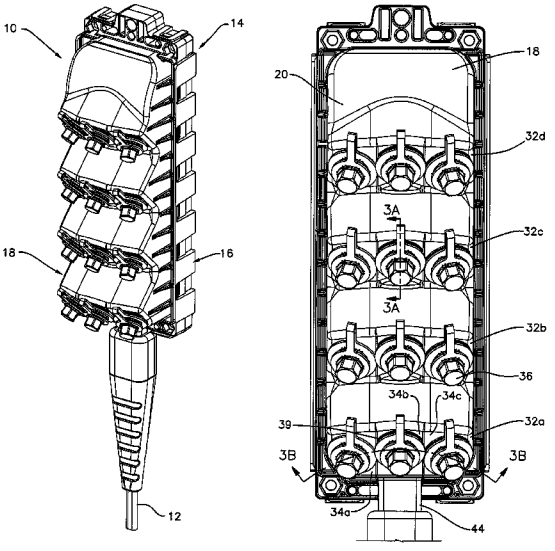

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FIG. 1A

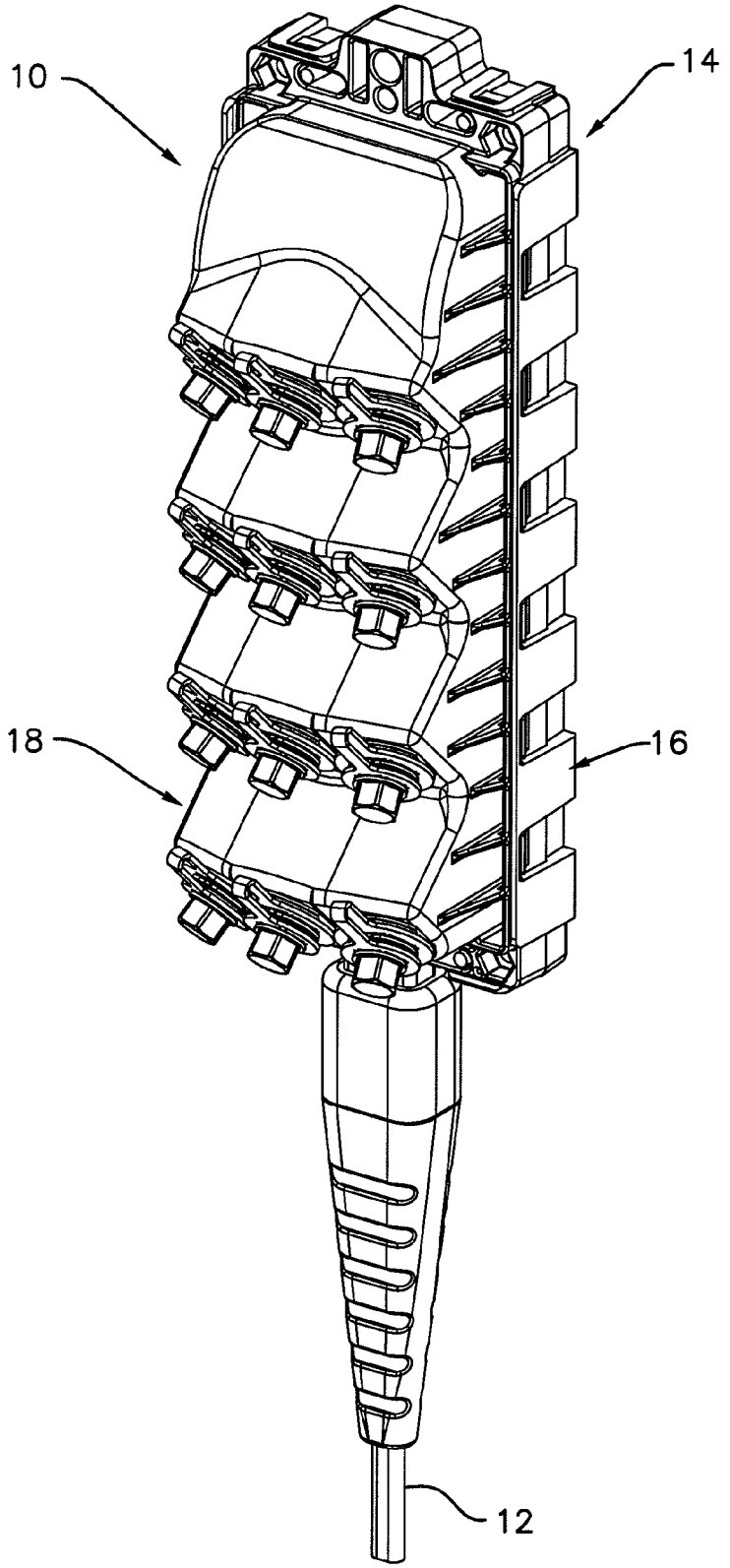


FIG. 1B

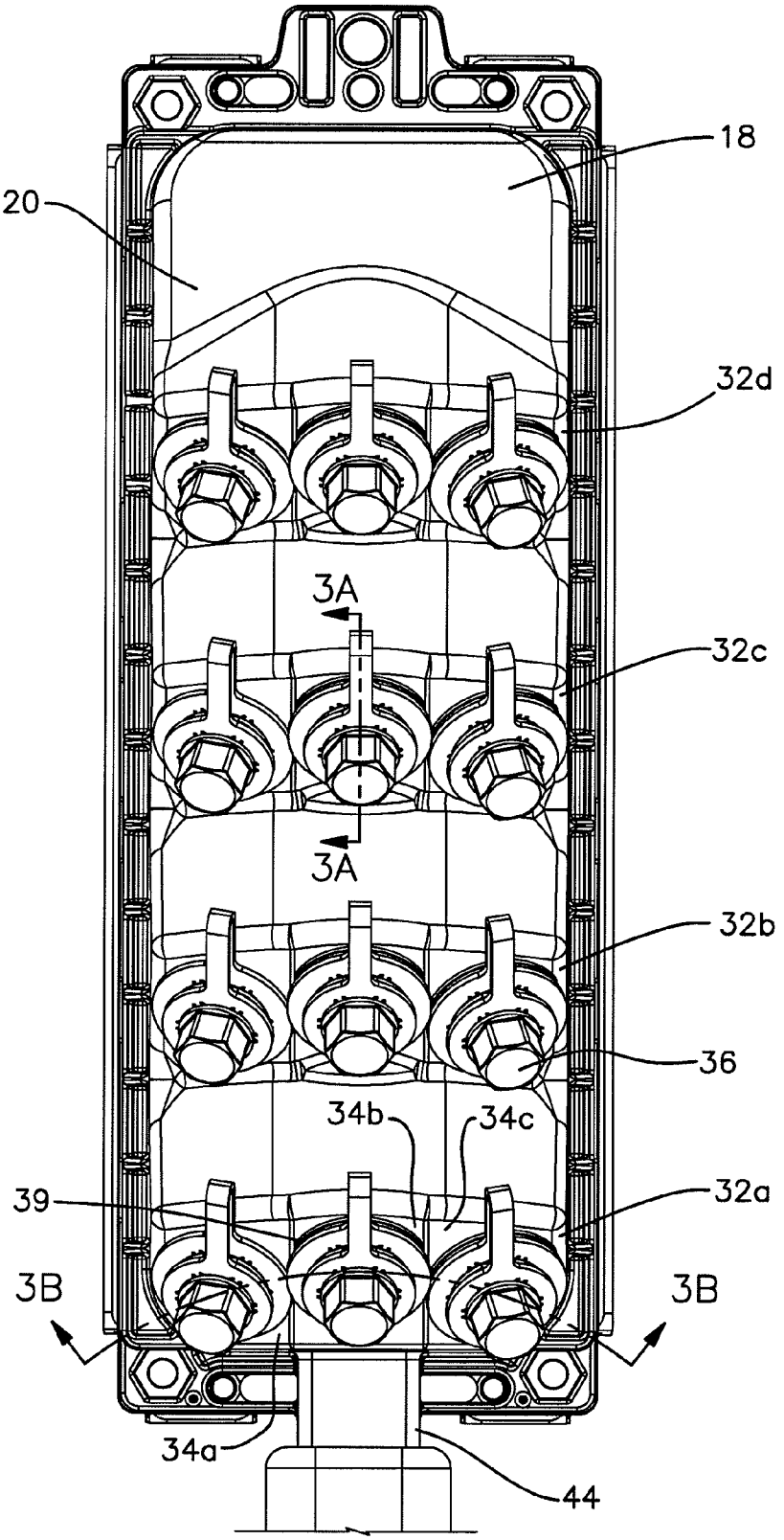


FIG. 1C

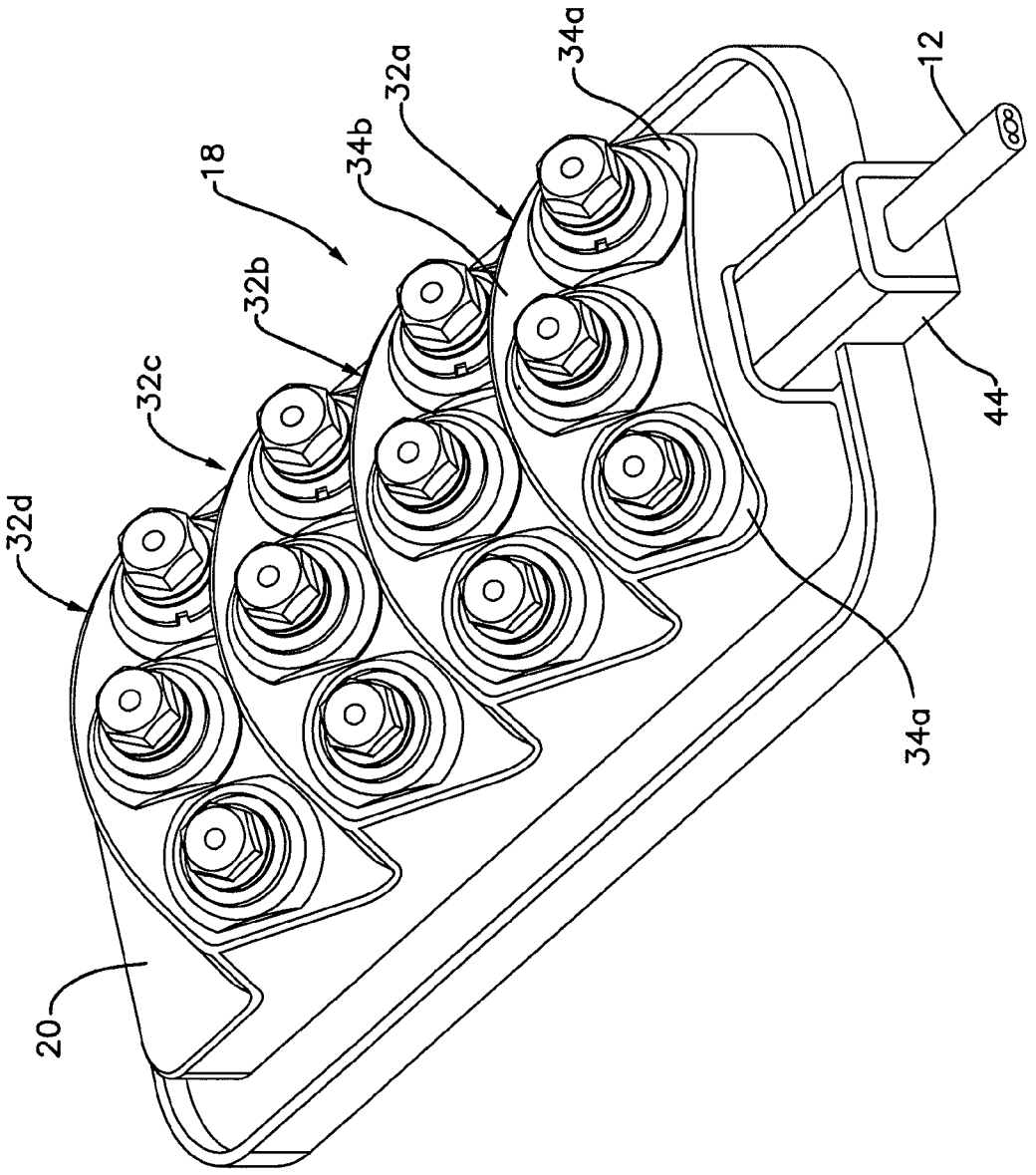


FIG. 2

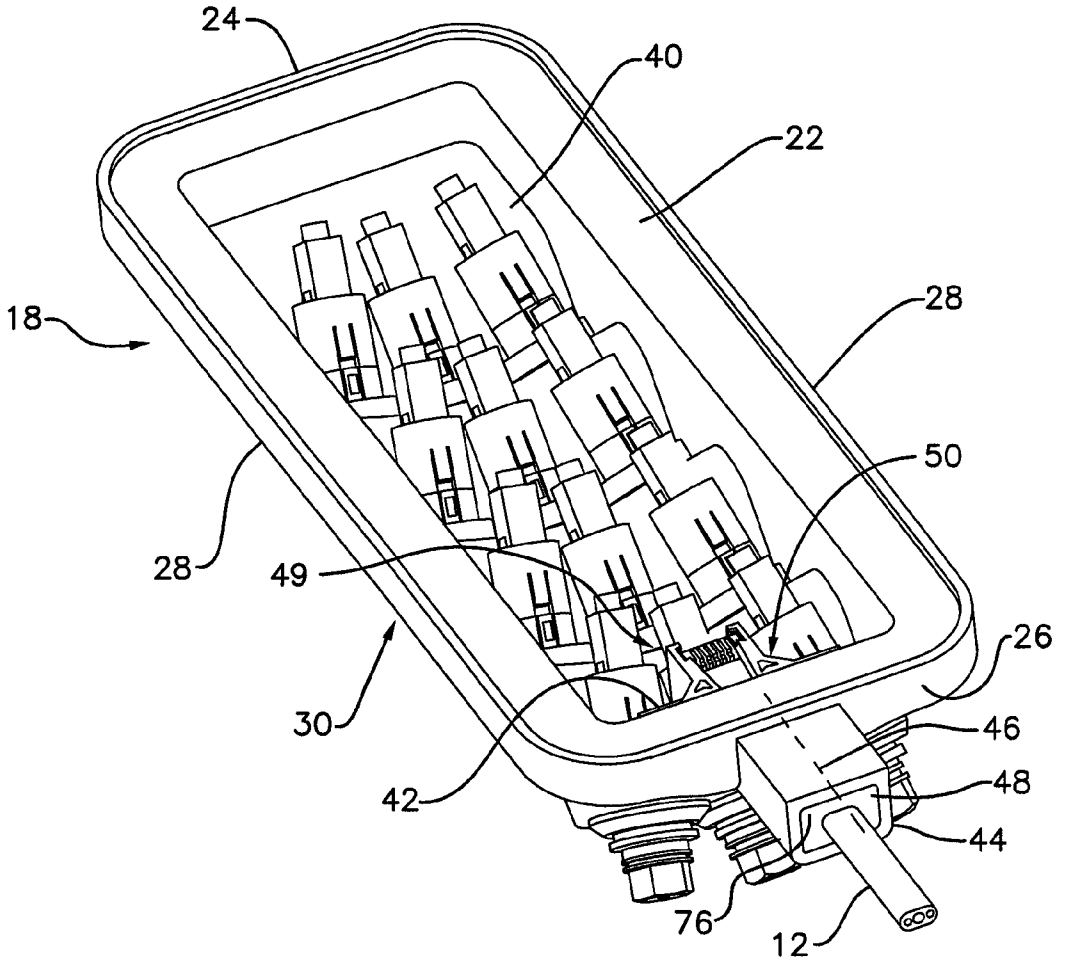


FIG. 3A

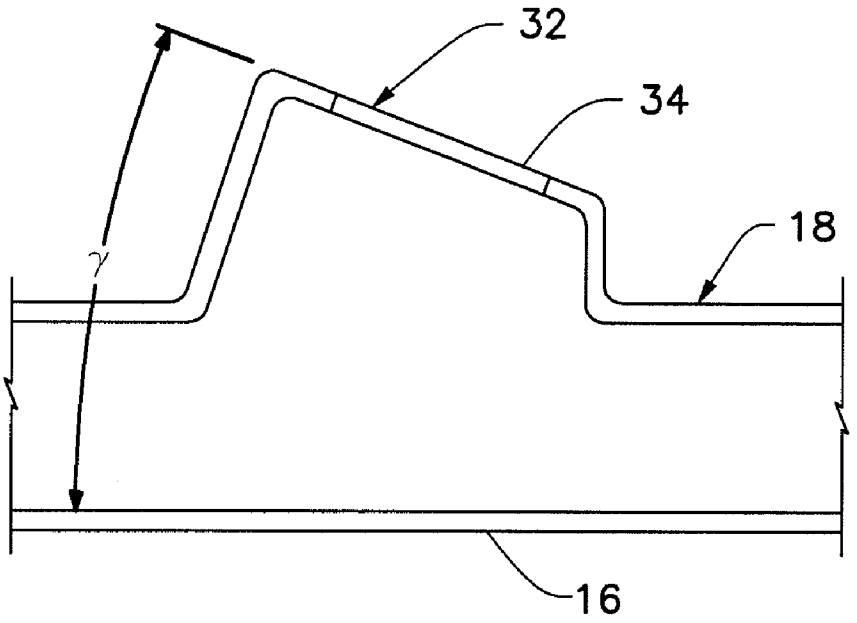
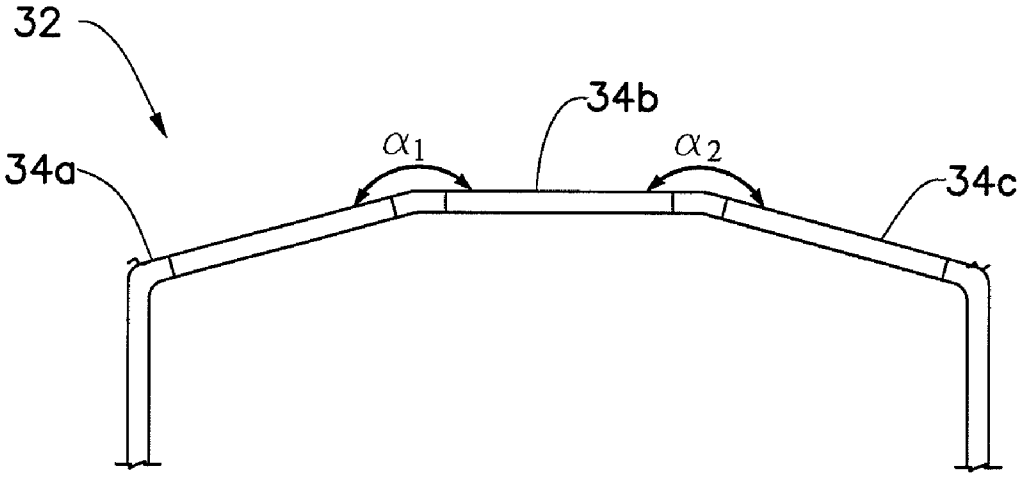


FIG. 3B



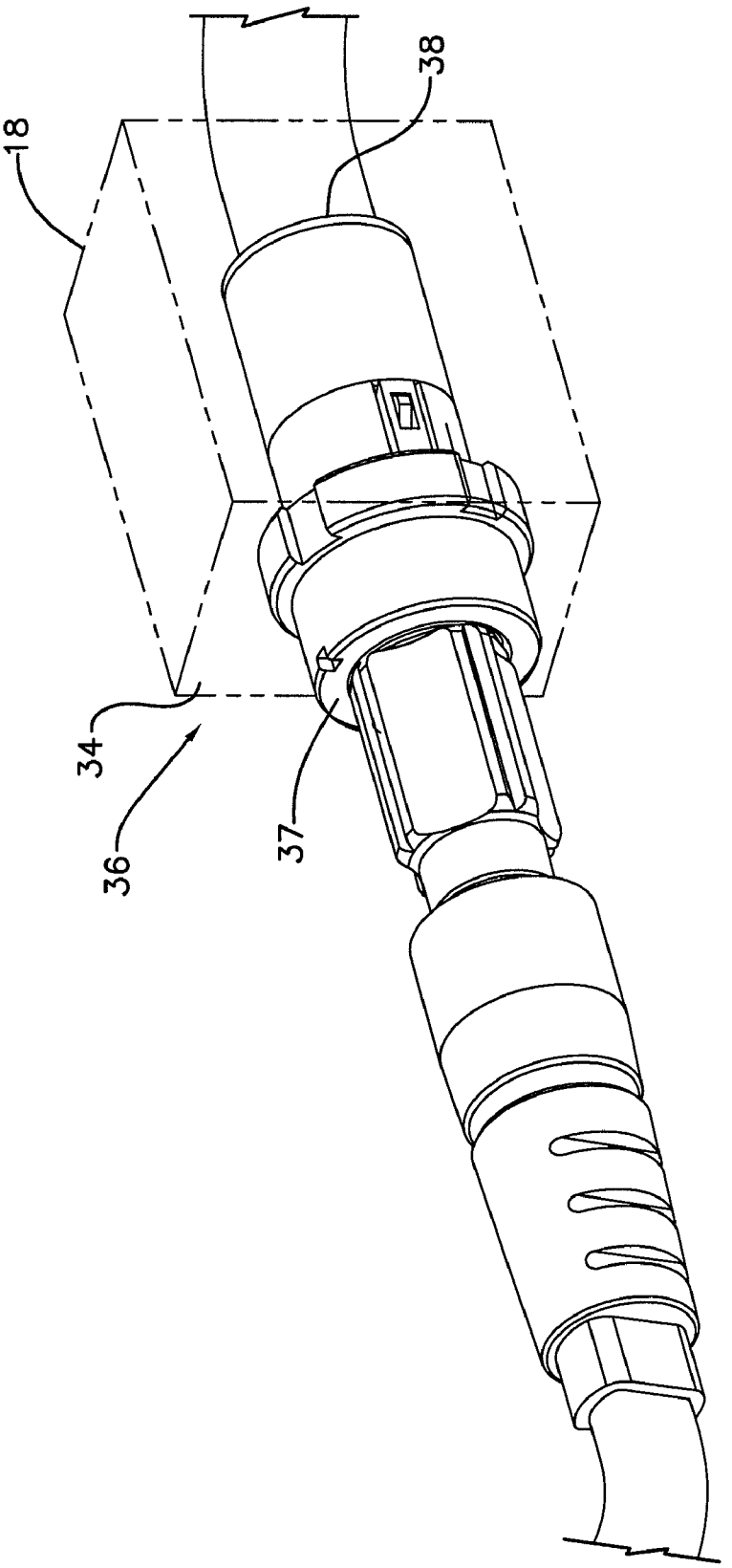
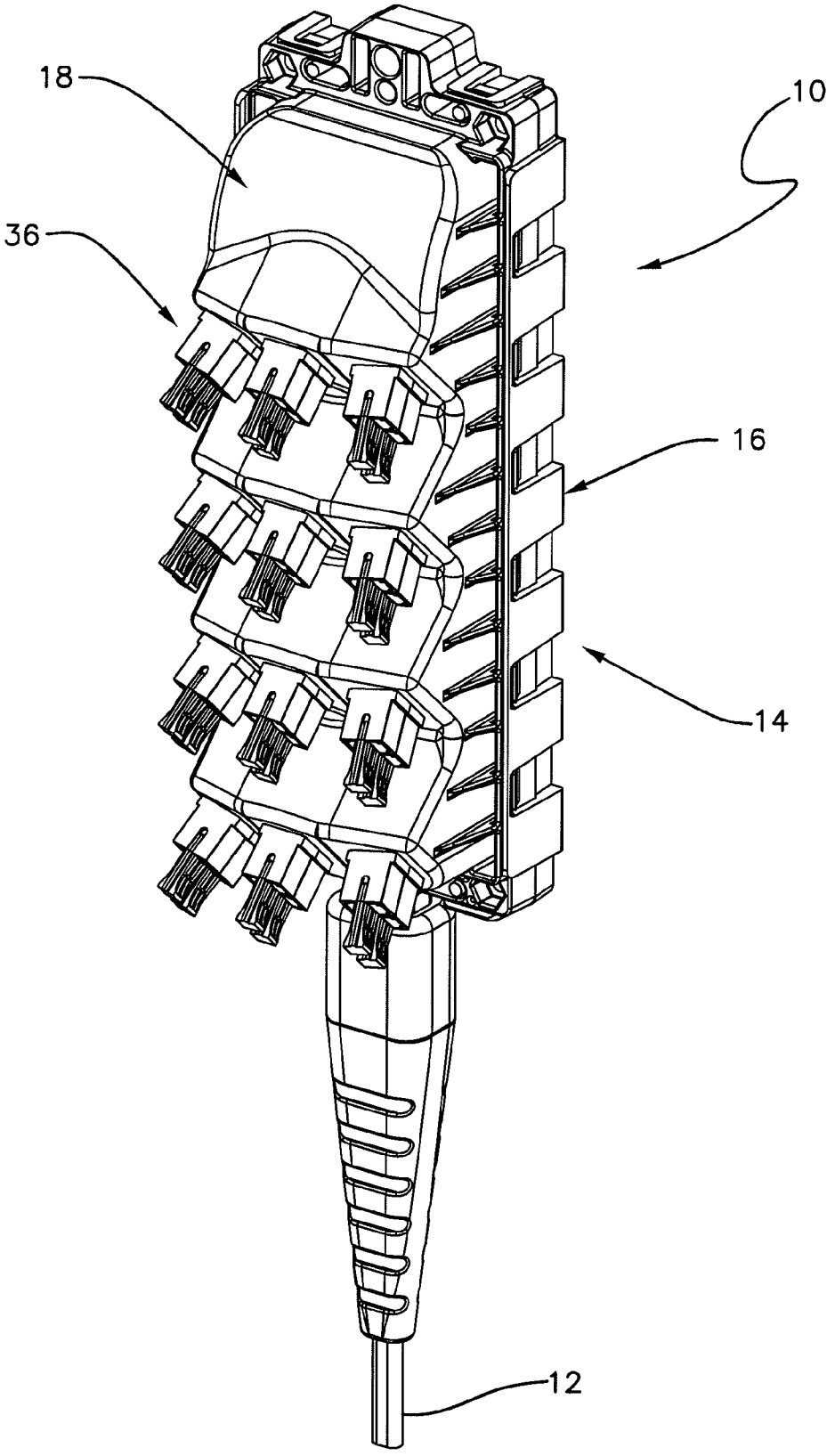


FIG. 4

FIG. 5



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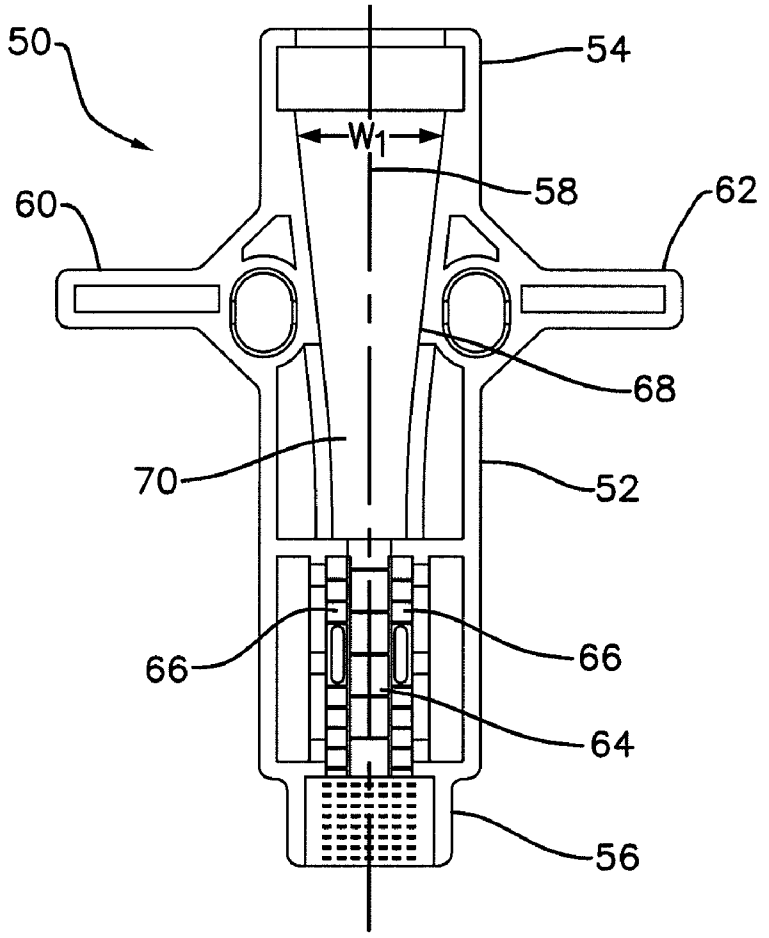

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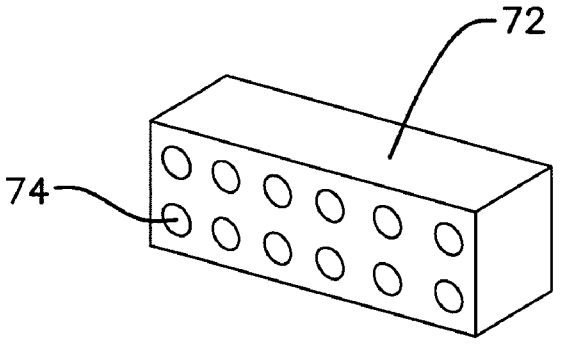
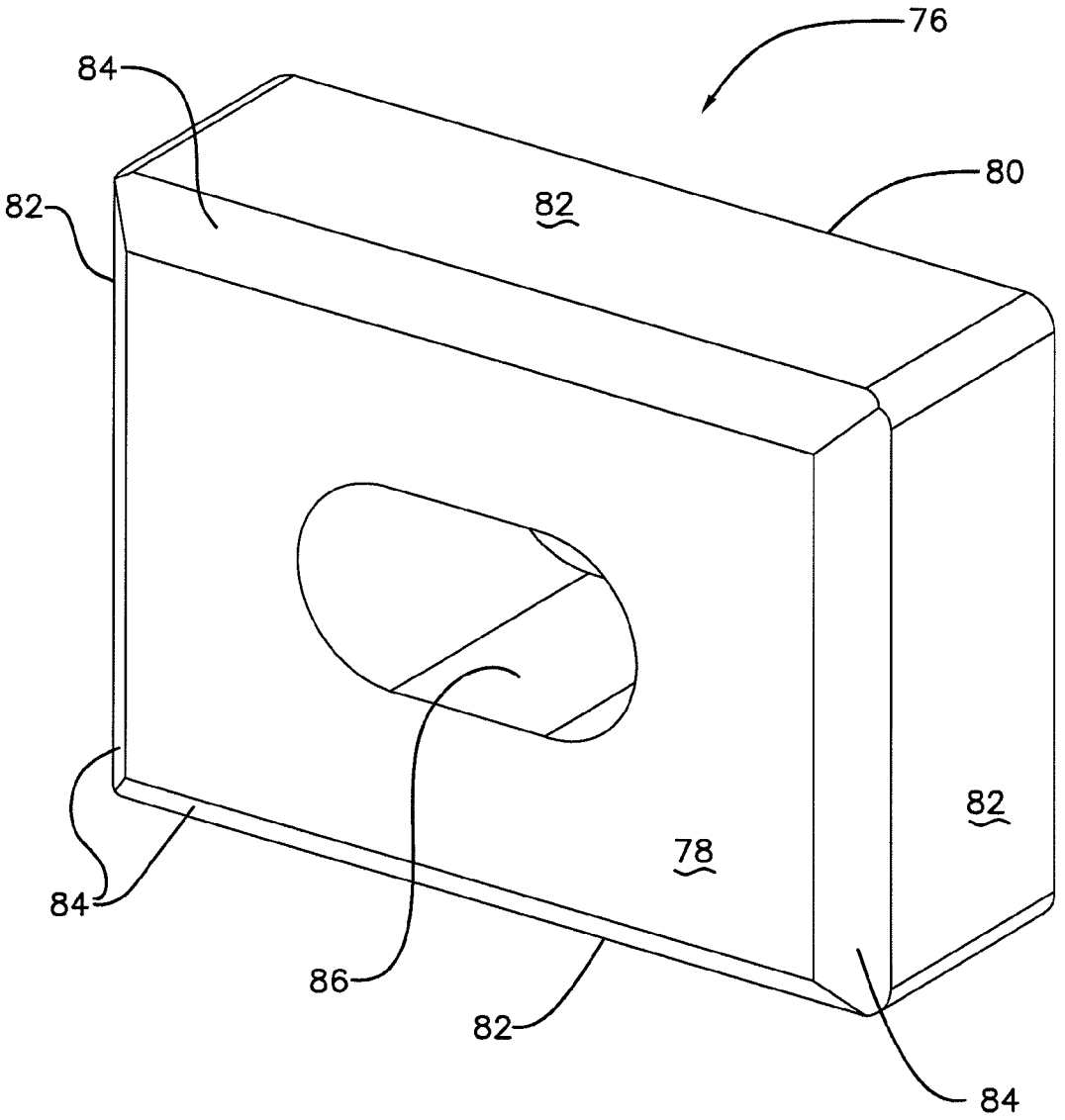


FIG. 8



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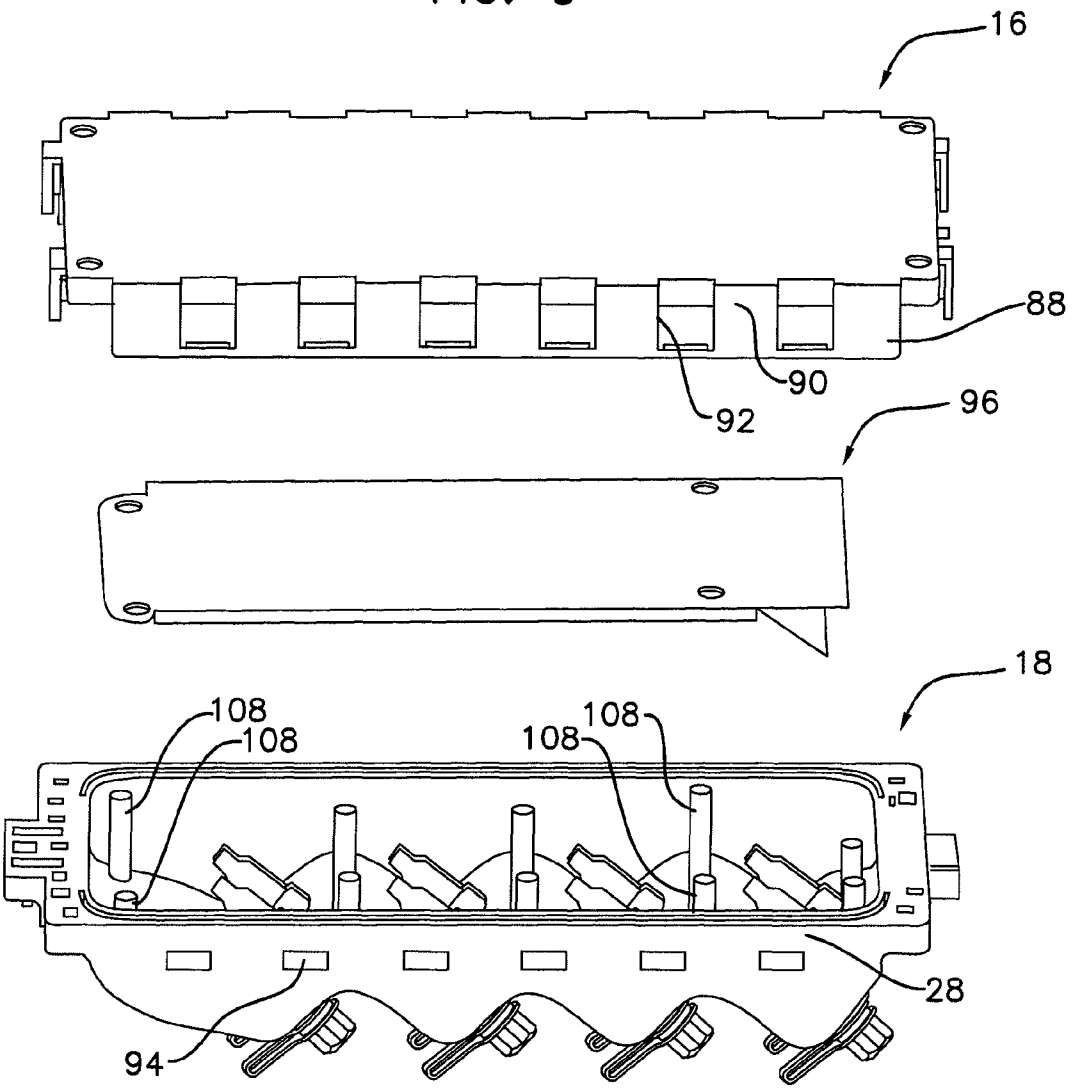

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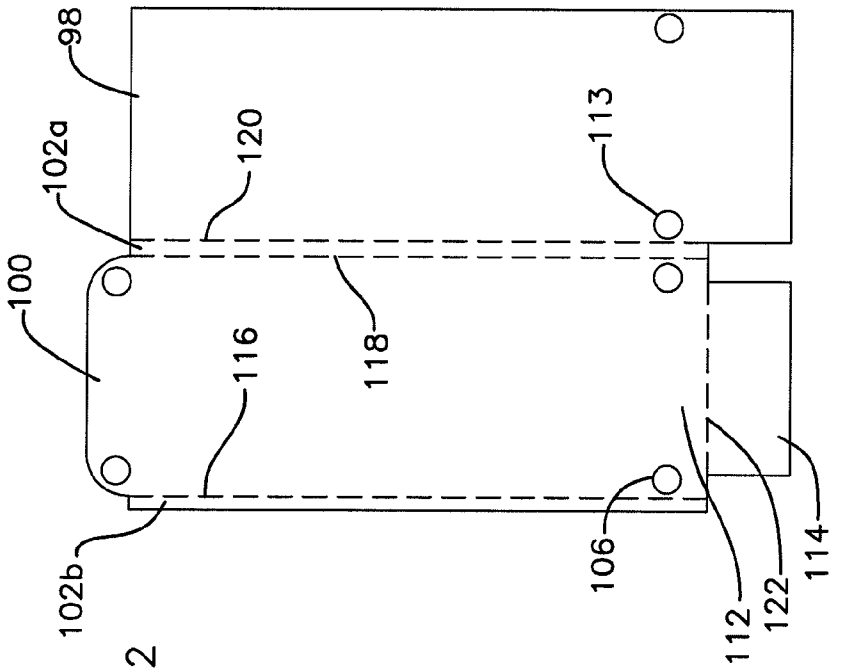
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FIG. 10

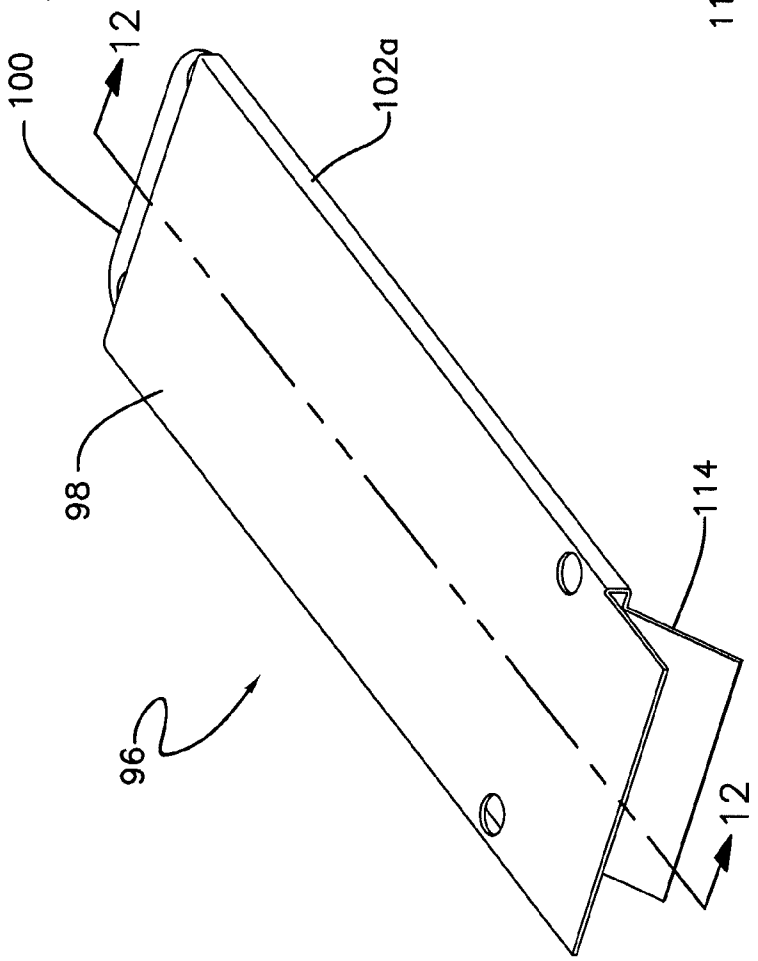
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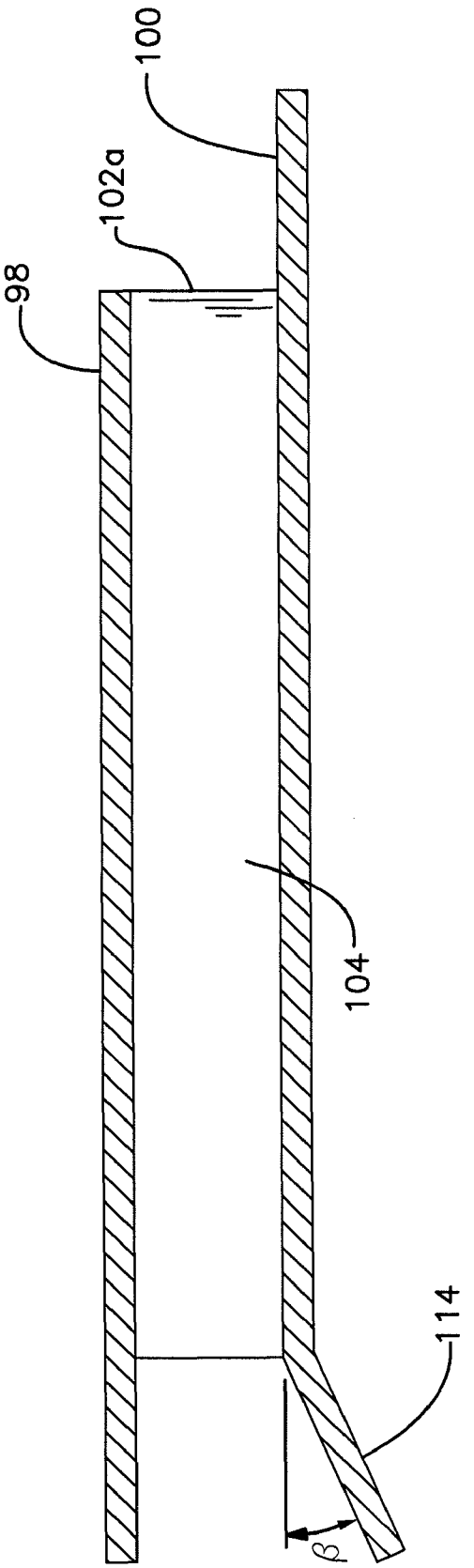
FIG. 12



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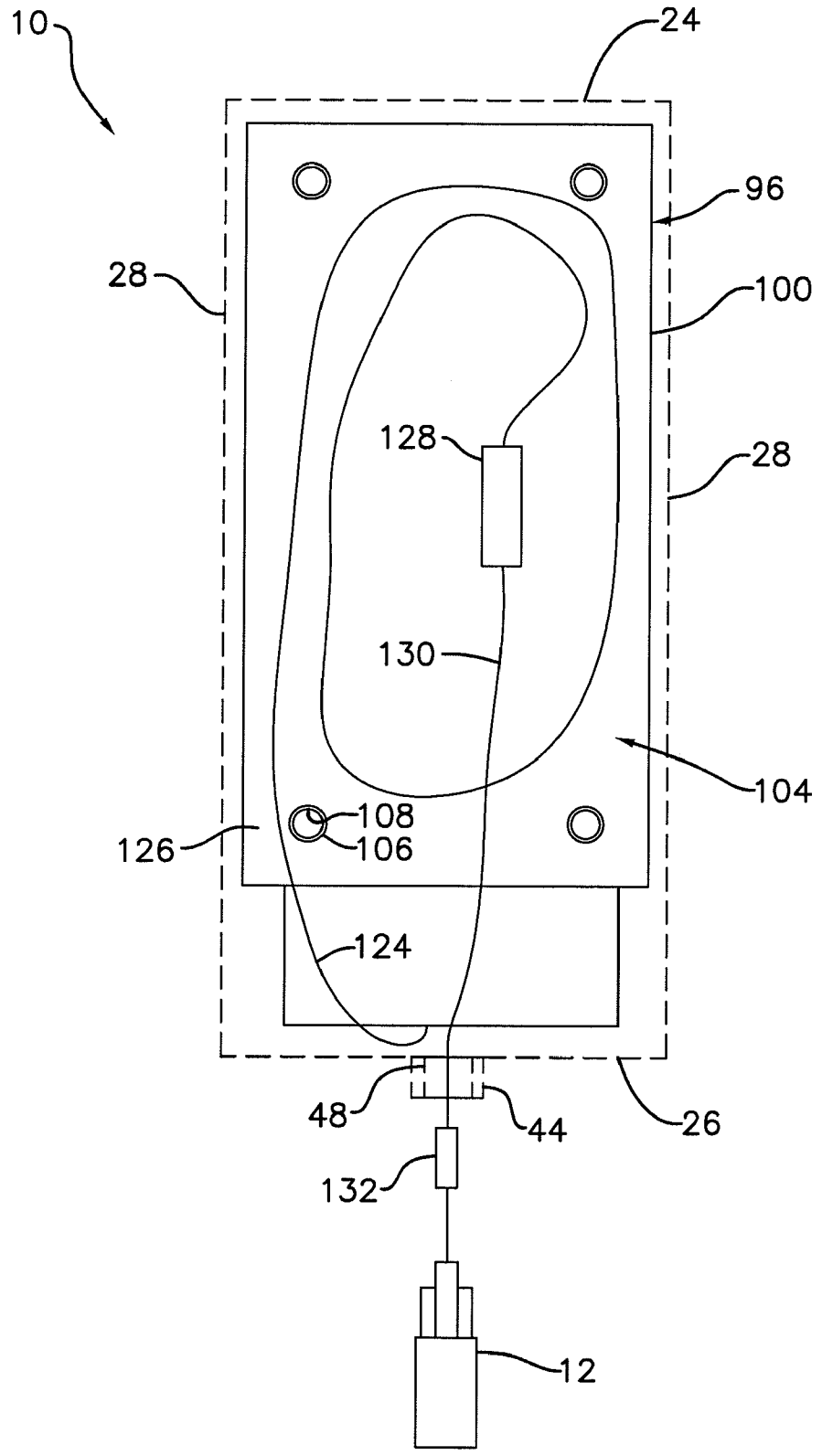


FIG. 14

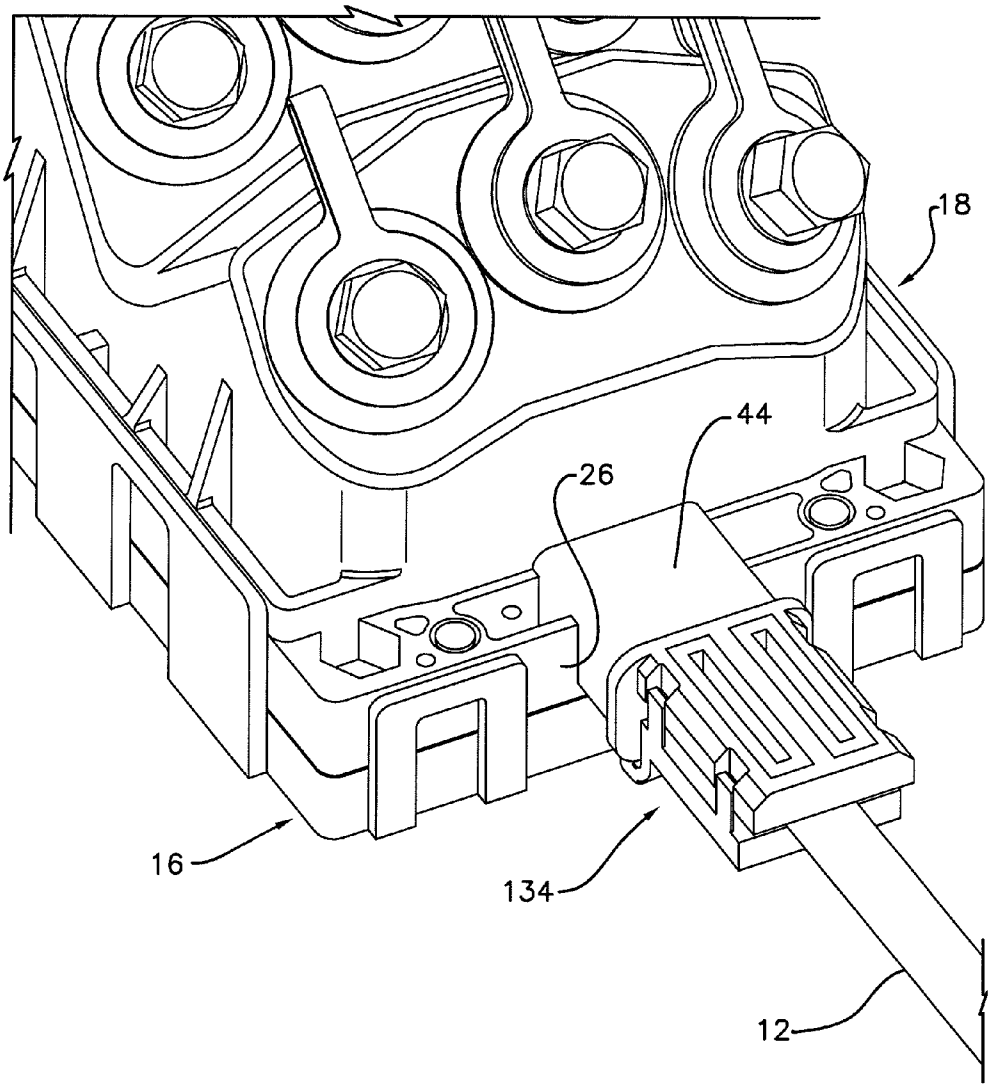


FIG. 15

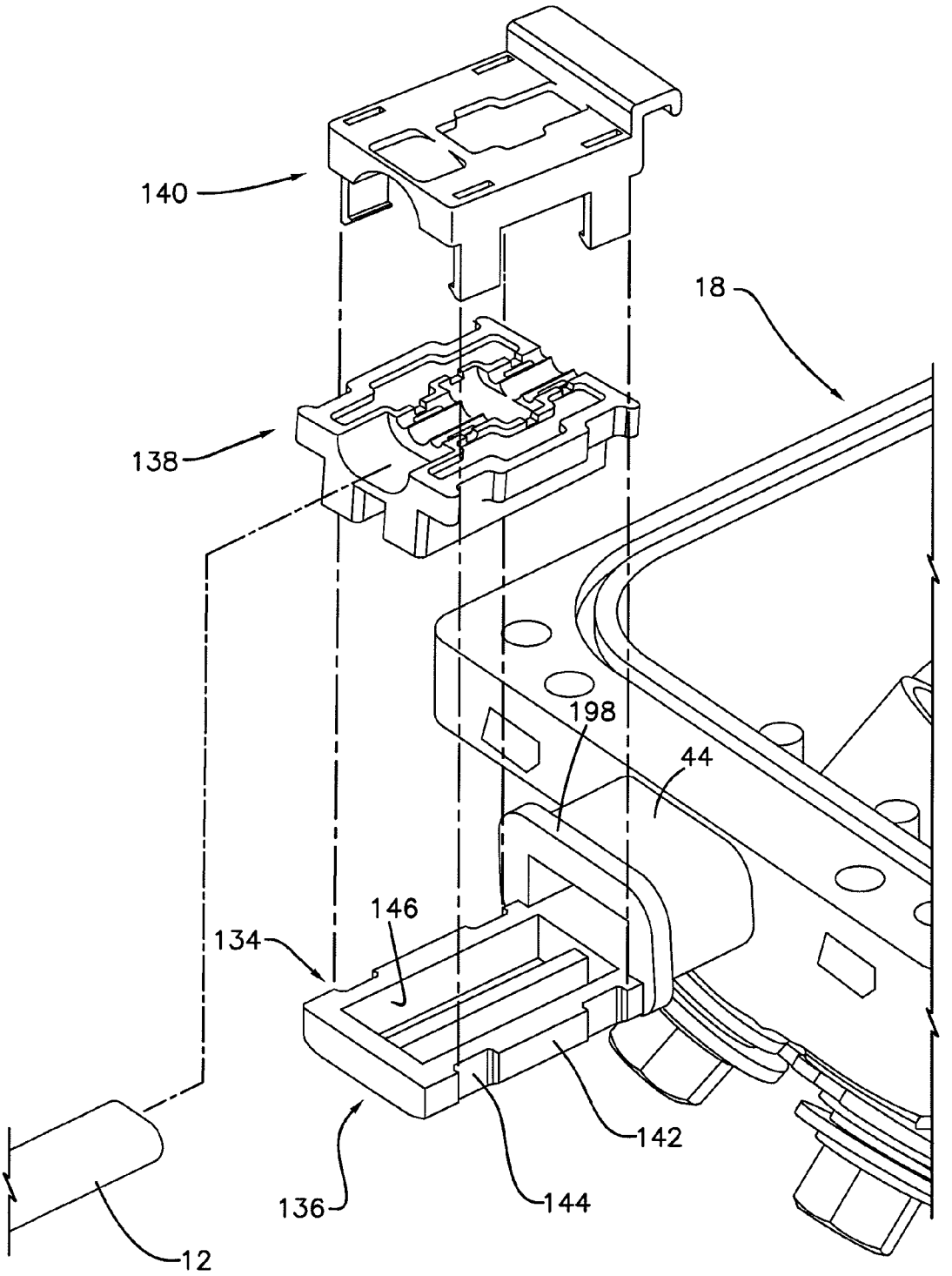
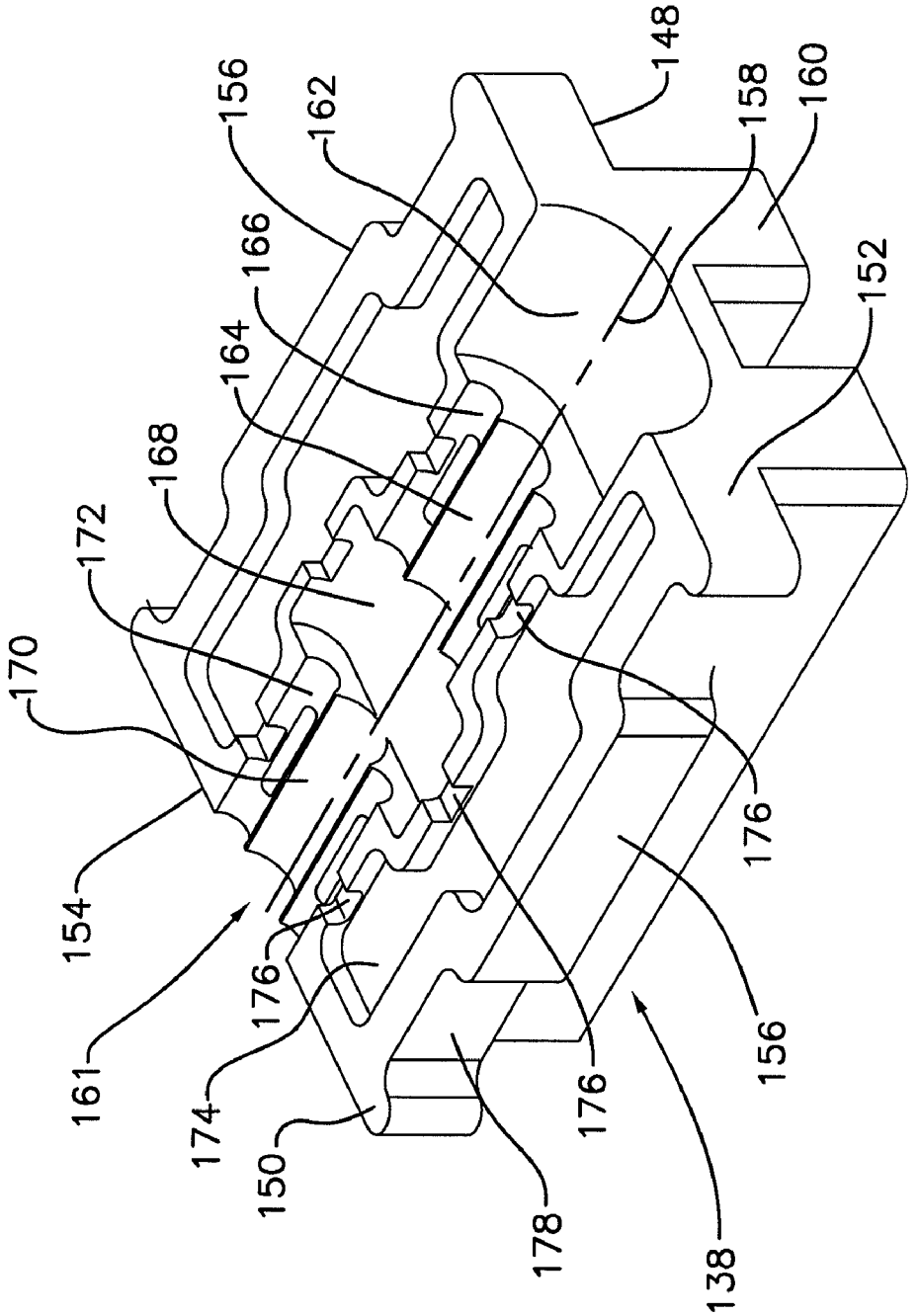


FIG. 16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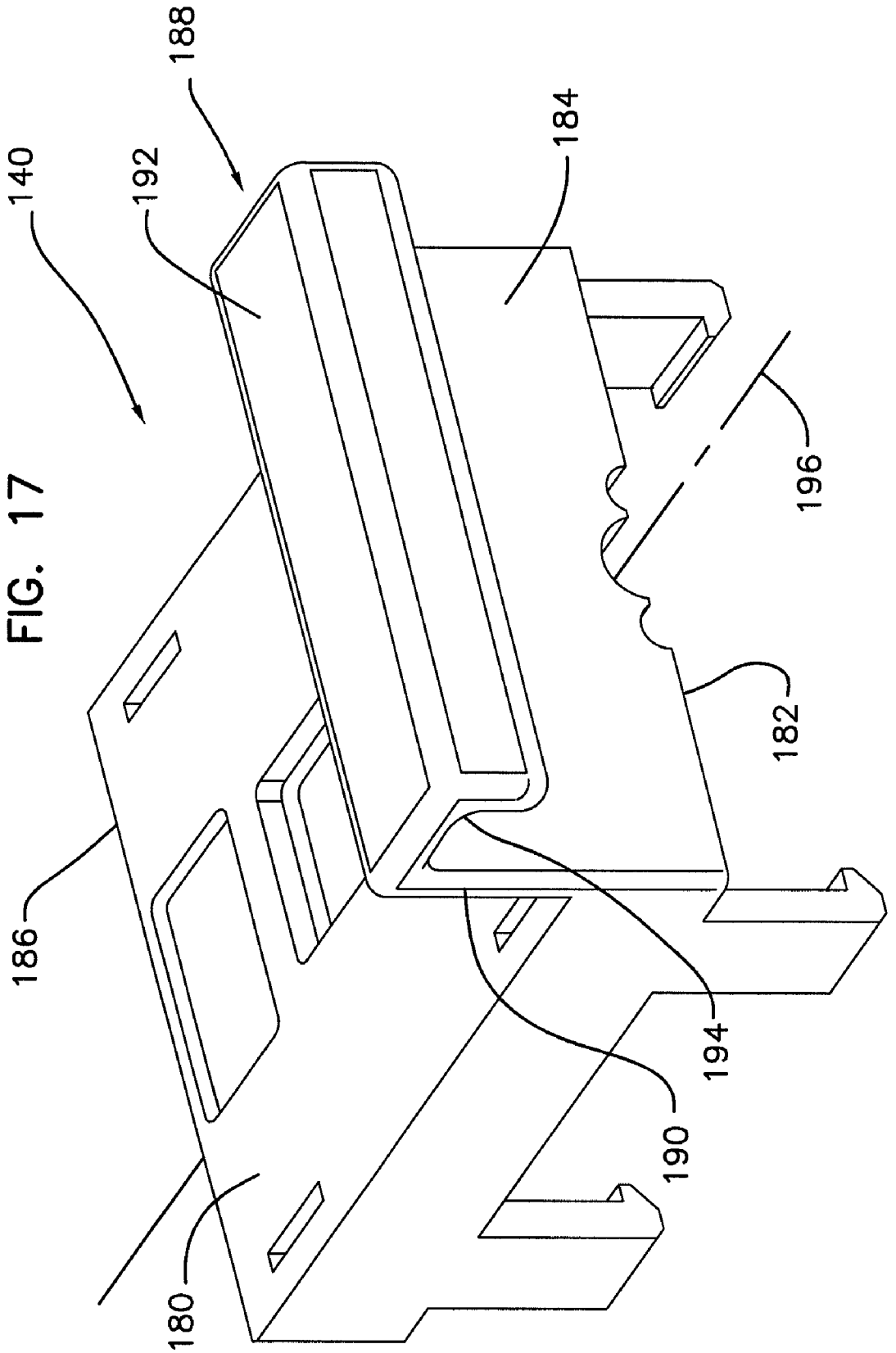


FIG. 17

FIG. 18

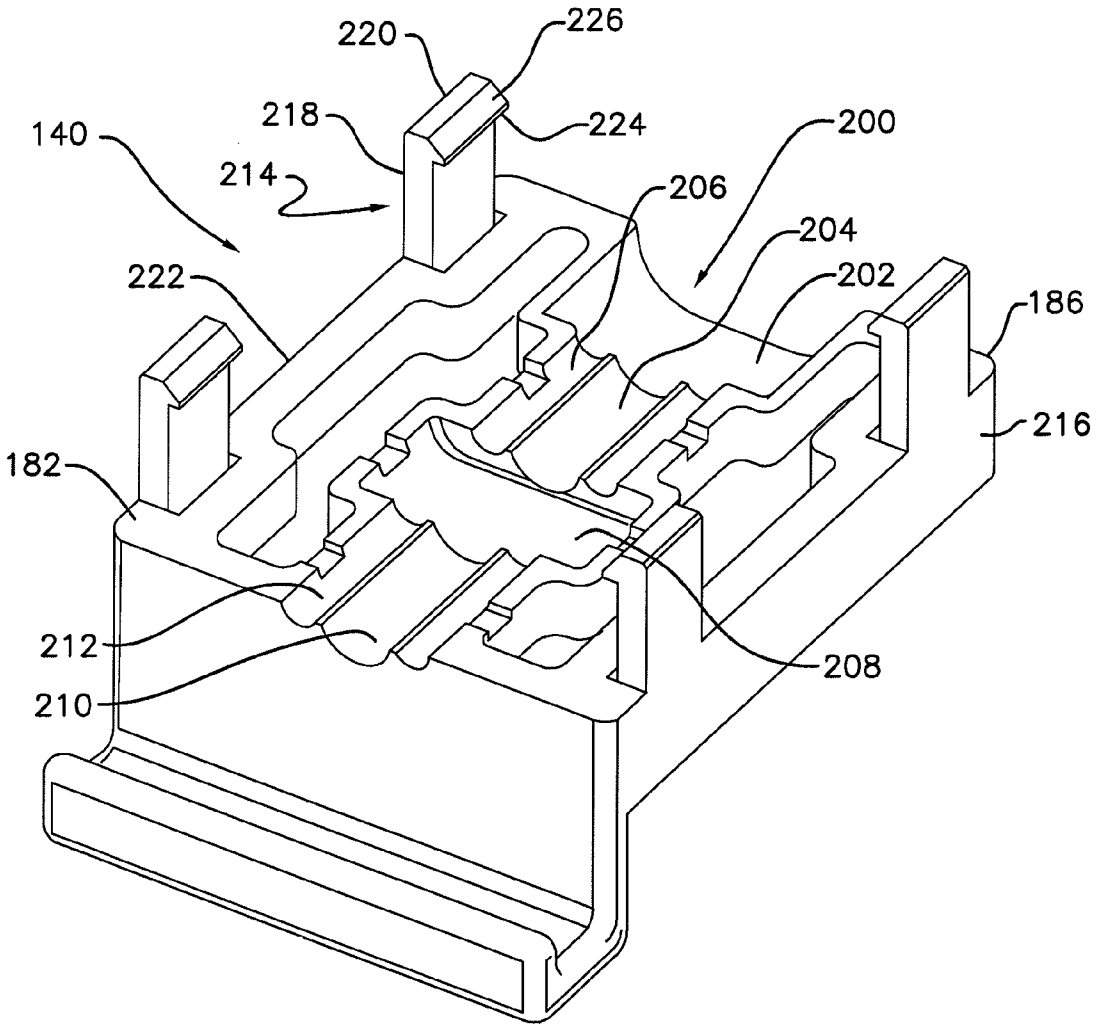

220
226
218
224
140
200
214
206
204
222
202
186
216
182
212
208
210

FIG. 19

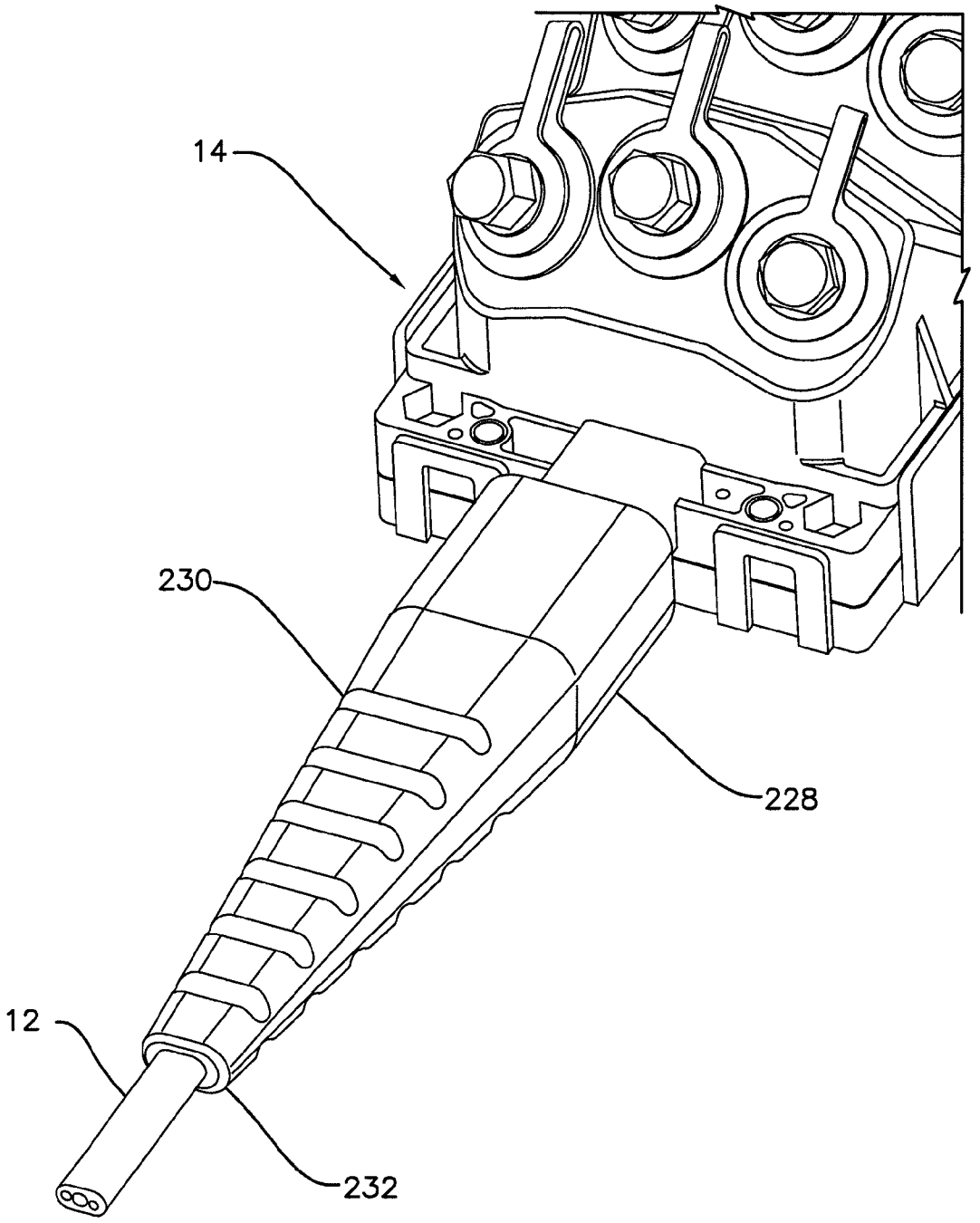


FIG. 20

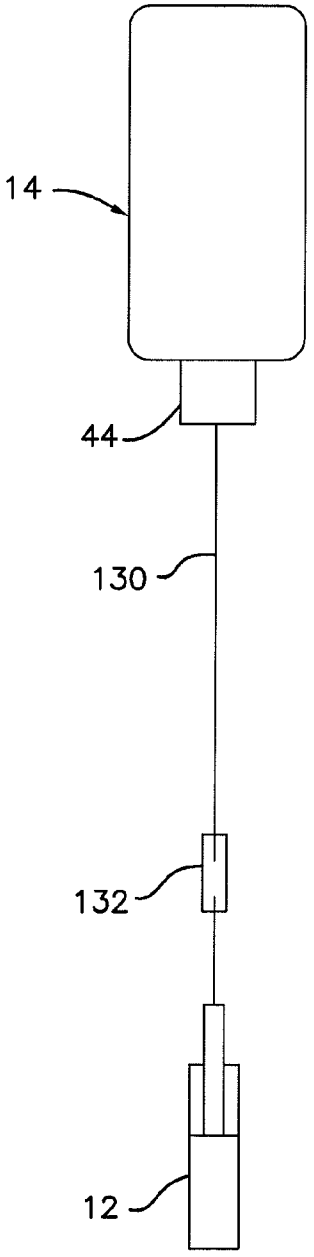


FIG. 21

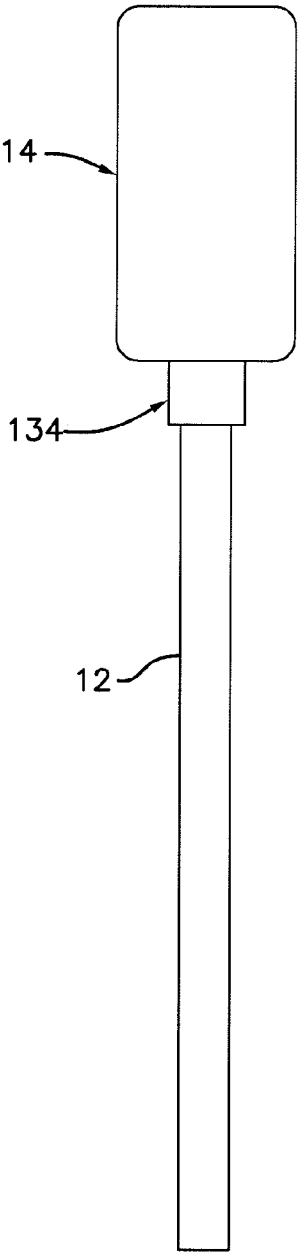


FIG. 22

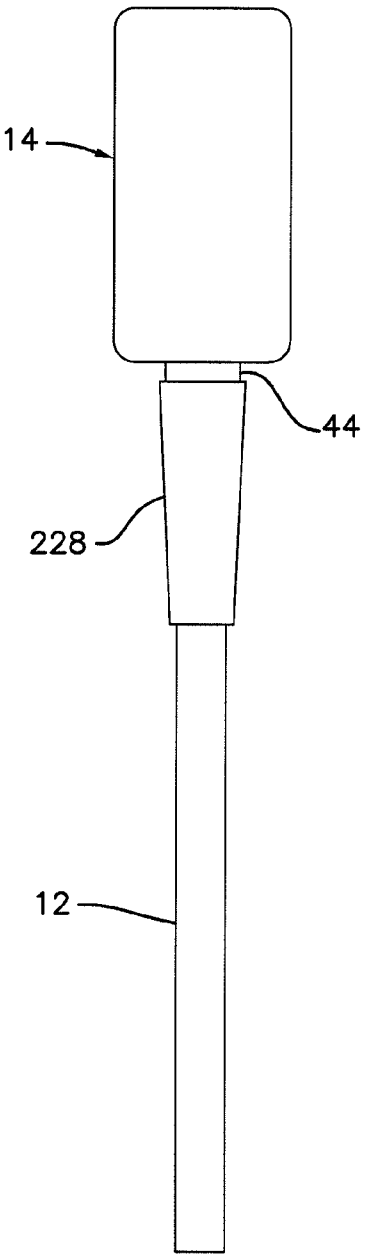


FIG. 23

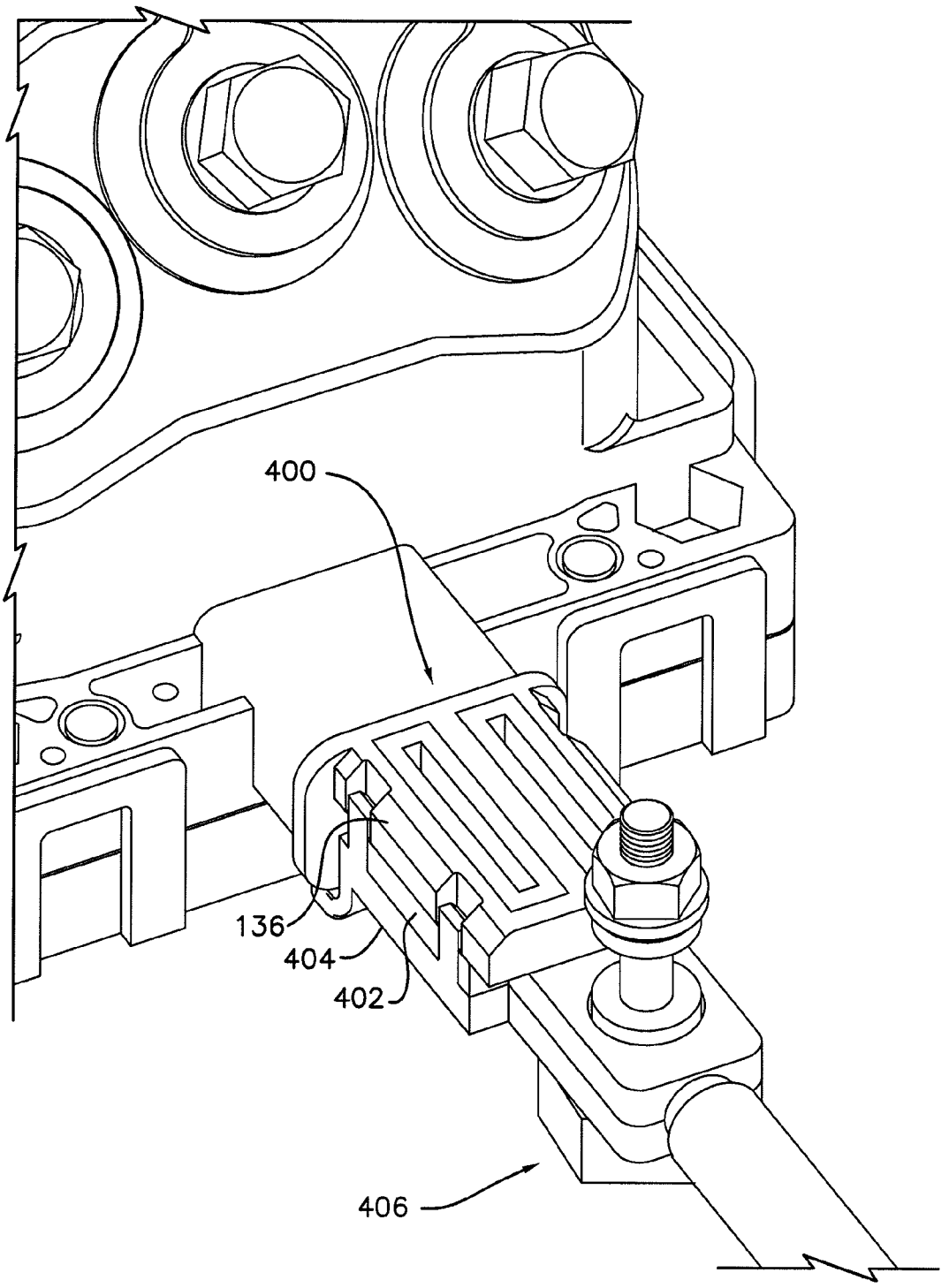
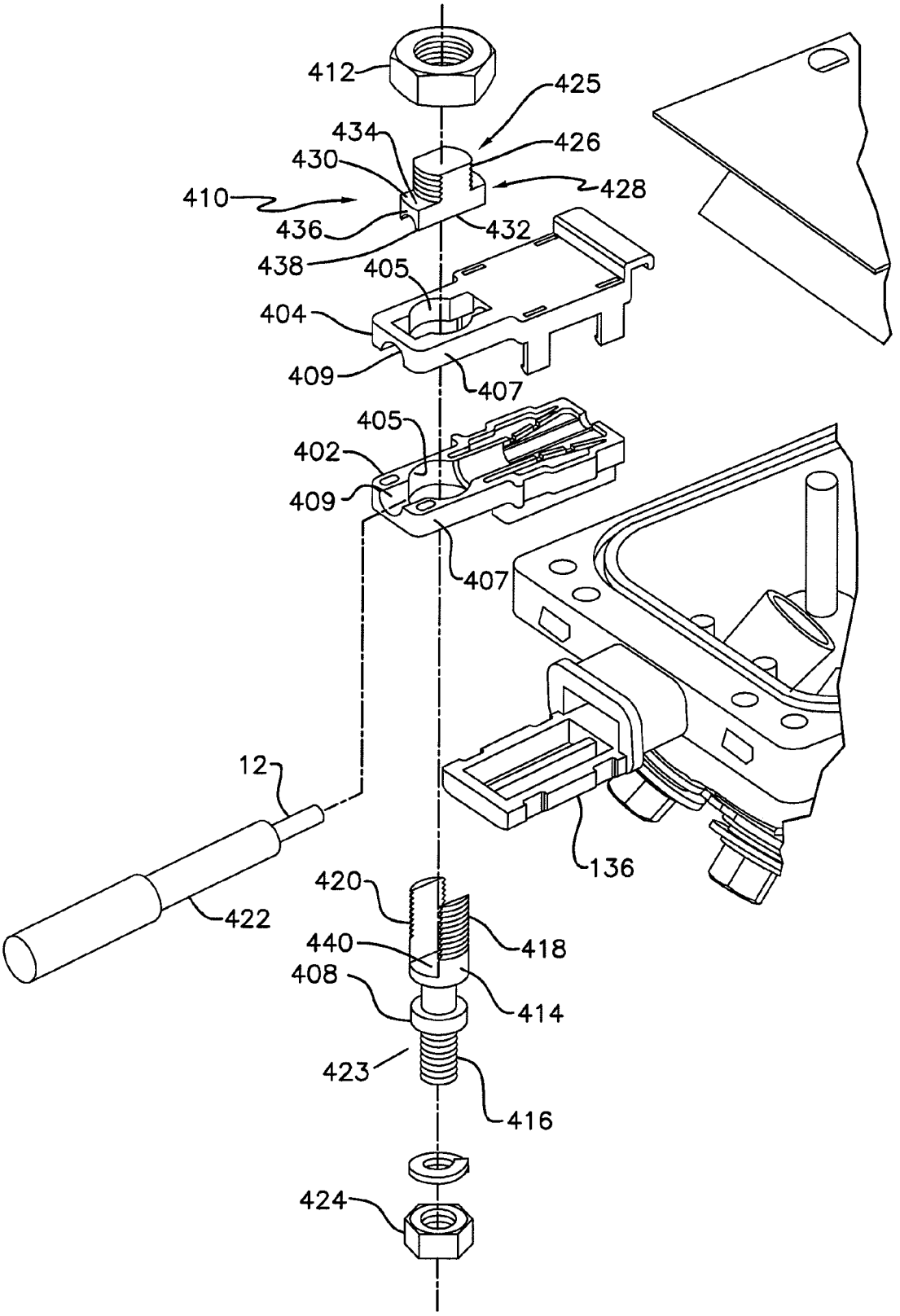


FIG. 24


412
425
434
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405
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12
136
420
422
440
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408
414
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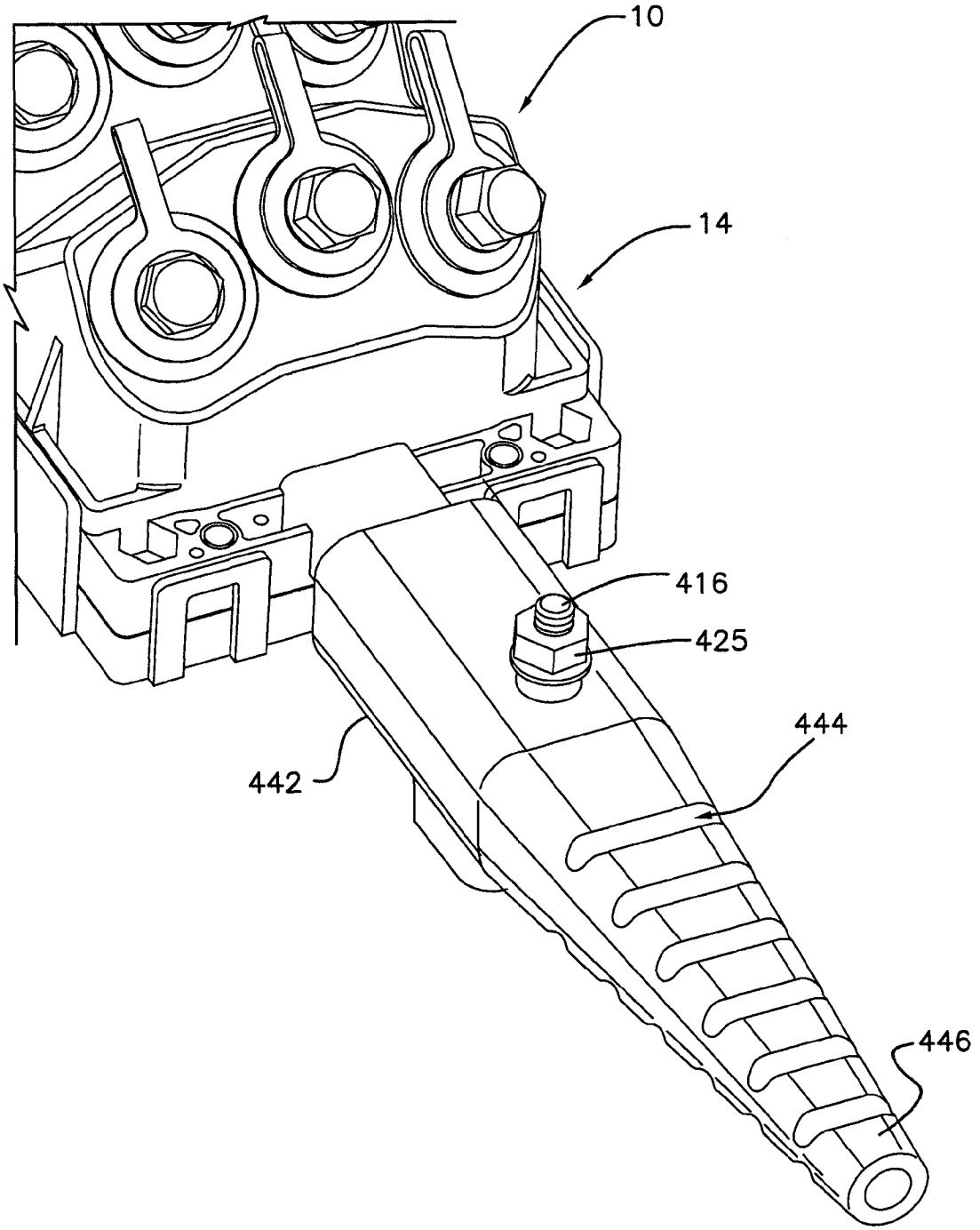
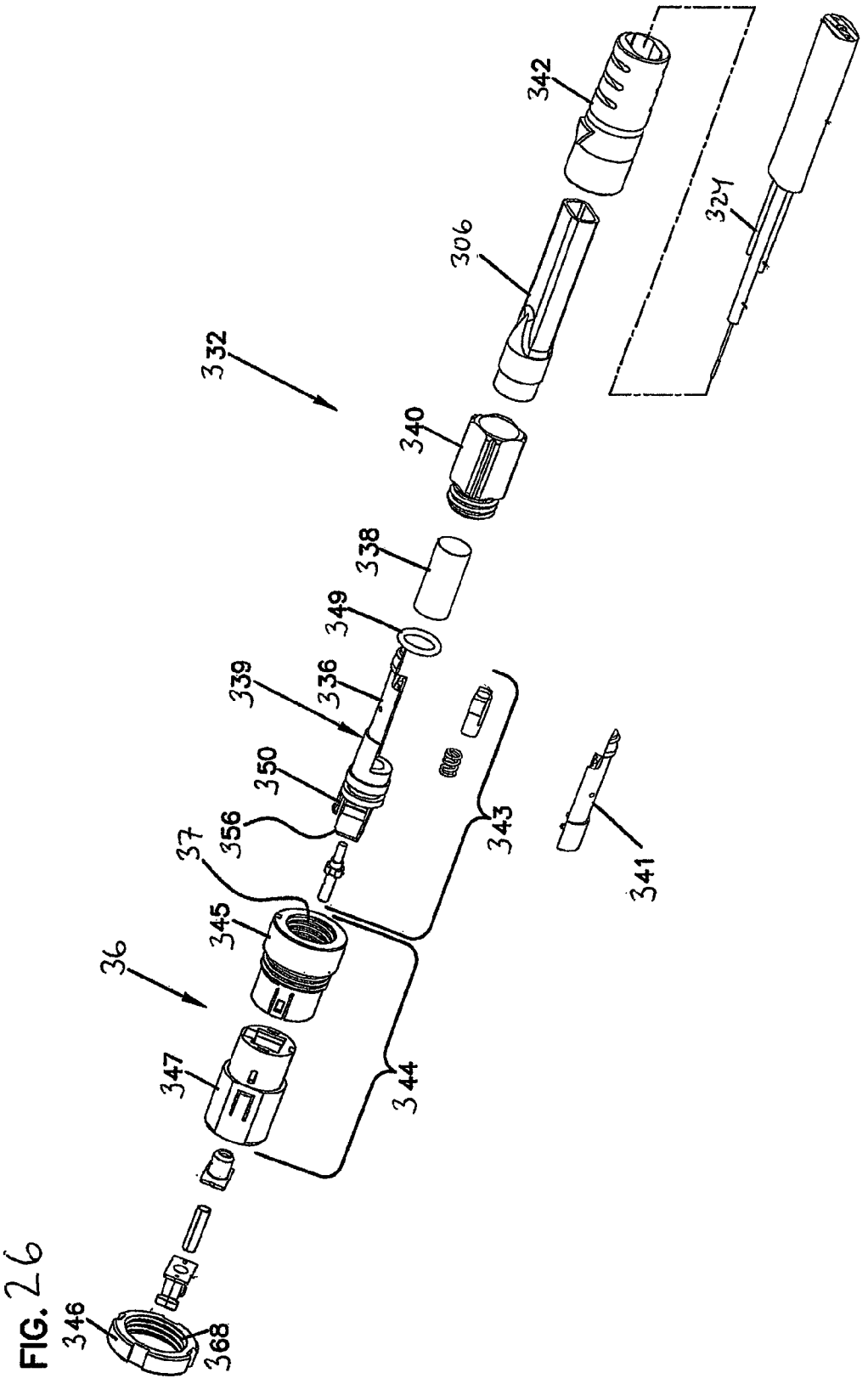
416
424

FIG. 25




342
306
324
332
340
338
349
339
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356
37
345
36
347
343
341
344
346
368

FIG. 26

MINI DROP TERMINAL

CROSS REFERENCE TO RELATED APPLICATIONS

This application is a divisional application of U.S. patent application Ser. No. 12/248,564, entitled "Mini Drop Terminal" and filed on Oct. 9, 2008, which claims the benefit of U.S. Provisional Patent Application Ser. No. 60/978,638, filed Oct. 9, 2007, which applications are hereby incorporated by reference in their entirety.

TECHNICAL FIELD

The present disclosure relates to fiber optic cable termination systems, and more particularly, to drop terminals used in fiber optic cable telecommunication systems.

BACKGROUND

Fiber optic cables are widely used to transmit light signals for high speed data transmission. A fiber optic cable typically includes: (1) an optical fiber or optical fibers; (2) a buffer or buffers that surrounds the fiber or fibers; (3) a strength layer that surrounds the buffer or buffers; and (4) an outer jacket. Optical fibers function to carry optical signals. A typical optical fiber includes an inner core surrounded by a cladding that is covered by a coating. Buffers (e.g., loose or tight buffer tubes) typically function to surround and protect coated optical fibers. Strength layers add mechanical strength to fiber optic cables to protect the internal optical fibers against stresses applied to the cables during installation and thereafter. Example strength layers include aramid yarn, steel and epoxy reinforced glass roving. Outer jackets provide protection against damage caused by crushing, abrasions, and other physical damage. Outer jackets also provide protection against chemical damage (e.g., ozone, alkali, acids).

Fiber optic cable connection systems are used to facilitate connecting and disconnecting fiber optic cables in the field without requiring a splice. A typical fiber optic cable connection system for interconnecting two fiber optic cables includes fiber optic connectors mounted at the ends of the fiber optic cables, and an adapter for mechanically and optically coupling the fiber optic connectors together. Fiber optic connectors generally include ferrules that support the ends of the optical fibers of the fiber optic cables. The end faces of the ferrules are typically polished and are often angled. The adapter includes co-axially aligned ports (i.e., receptacles) for receiving the fiber optic connectors desired to be interconnected. The adapter includes an internal sleeve that receives and aligns the ferrules of the fiber optic connectors when the connectors are inserted within the ports of the adapter. With the ferrules and their associated fibers aligned within the sleeve of the adapter, a fiber optic signal can pass from one fiber to the next. The adapter also typically has a mechanical fastening arrangement (e.g., a snap-fit arrangement) for mechanically retaining the fiber optic connectors within the adapter. One example of an existing fiber optic connection system is described in U.S. Pat. Nos. 6,579,014, 6,648,520, and 6,899,467.

Fiber optic telecommunication technology is becoming prevalent in part because service providers want to deliver high bandwidth communication capabilities to subscribers. One such technology is referred to as passive optical networks (PONS). PONS may use optical fibers deployed between a service provider central office, or head end, and one or more end user premises. A service provider may employ a central office, or head end, containing electronic equipment for placing signals onto optical fibers running to user premises. End user premises may employ equipment for receiving optical signals from the optical fibers. In PONS, the central office, or head end, transmission equipment and/or the transmission equipment located at the end user premises may, respectively, use a laser to inject data onto a fiber in a manner that may not require the use of any active components, such as amplifiers between the central office, or head end, and/or the end user premises. In other words, only passive optical components, such as splitters, optical fibers, connectors and/or splices, may be used between a service provider and an end user premises in PONS. PONS may be attractive to service providers because passive networks may be less costly to maintain and/or operate as compared to active optical networks and/or older copper based networks, such as a public switched telephone network (PSTN). In addition to possibly being less expensive than other network topologies, PONS may provide sufficient bandwidth to meet a majority of end users' high bandwidth communication needs into the foreseeable future.

In PONS, transmission equipment may transmit signals containing voice, data and/or video over a fiber strand to the premises. An optical fiber may be split using, for example, passive optical splitters so that signals are dispersed from one fiber (the input fiber) to multiple output fibers running to, for example, user premises from a convergence point in the network. An optical fiber routed to a user's premises may be routed via a fiber drop terminal en route to the premises. At the fiber drop terminal, signals appearing on one or more optical fibers may be routed to one or more end user premises. Fiber drop terminals may be mounted in aerial applications, such as near the tops of utility poles, along multi-fiber and/or multi-conductor copper strands suspended between utility poles. Fiber drop terminals may also be installed in junction boxes mounted at ground level and/or in below-grade vaults where utilities are run below ground. Example fiber drop terminals are disclosed at U.S. Pat. No. 7,120,347; U.S. Patent Publication No. 2005/0213921 (now U.S. Pat. No. 7,292,763); and U.S. Patent Publication No. 2006/0153517 (now U.S. Pat. No. 7,680,388).

SUMMARY

An aspect of the present disclosure relates to a terminal for mounting to a fiber distribution cable. The terminal includes a housing having a base and a cover. The cover is connectedly engaged with the base. The terminal further includes a plurality of adapters disposed on the cover. A fiber routing tray having a top panel and a bottom panel is disposed in an interior cavity defined by the base and the cover. The fiber routing tray includes a storage space defined between the top and bottom panels for storing a length of optical fiber.

Another aspect of the present disclosure relates to a retention device for securing a fiber distribution cable to a terminal. The retention device includes a base piece, a body and a cover piece. The body includes a lower surface engaged with the base piece and an oppositely disposed upper surface that defines a fiber passage. The fiber passage has a recess configured to receive a splice that couples a first cable and a second cable. The cover piece includes a top surface and a bottom surface defining a passage configured to receive the first and second cables. The cover piece is adapted for snap-fit engagement with the base piece such that the body is disposed between the base piece and the cover piece.

Another aspect of the present disclosure relates to a method for installing a terminal. The method includes providing a

terminal having a housing defining an interior cavity. A multi-fiber cable is pulled from the interior cavity of the housing. The multi-fiber cable is spliced to a fiber distribution cable with a multi-fiber splice. The multi-fiber cable is inserted back into the interior cavity of the housing. A spliced end of the multi-fiber cable, a spliced end of the fiber distribution cable and the multi-fiber splice are inserted in a retention device.

A variety of additional aspects will be set forth in the description that follows. These aspects can relate to individual features and to combinations of features. It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory only and are not restrictive of the broad concepts upon which the embodiments disclosed herein are based.

DESCRIPTION OF THE DRAWINGS

FIG. **1**A is a perspective view of a terminal having features that are examples of aspects in accordance with the principles of the present disclosure.

FIG. **1**B is a front view of the terminal of FIG. **1**A.

FIG. **1**C is a perspective view of a front side of a cover of the terminal of FIG. **1**A.

FIG. **2** is a perspective view of a rear view of the cover of FIG. **1**C.

FIG. **3**A is a cross-sectional view of an angled step of the cover taken on line **3**A-**3**A of FIG. **1**B.

FIG. **3**B is a cross-sectional view of an angled step of the cover taken on line **3**B-**3**B of FIG. **1**B.

FIG. **4** is a perspective view of an adapter suitable for use in the terminal of FIG. **1**A.

FIG. **5** is a perspective view of the terminal of FIG. **1**A having an alternate embodiment of adapters.

FIG. **6** is a front view of an anchor block suitable for use in the terminal of FIG. **1**A having features that are examples of aspects in accordance with the principles of the present disclosure.

FIG. **7** is a perspective view of a divider suitable for use with the anchor block of FIG. **6**.

FIG. **8** is a perspective view of a cable seal suitable for use in the terminal of FIG. **1**A having features that are examples of aspects in accordance with the principles of the present disclosure.

FIG. **9** is an exploded perspective view of the terminal of FIG. **1**A.

FIG. **10** is a perspective view of a fiber routing tray suitable for use in the terminal of FIG. **1**A having features that are examples of aspects in accordance with the principles of the present disclosure.

FIG. **11** is an expanded view of the fiber routing tray of FIG. **10**.

FIG. **12** is a cross-sectional view of the fiber routing tray taken on line **12**-**12** of FIG. **10**.

FIG. **13** is a schematic representation of a cable routing scheme for the terminal of FIG. **1**A.

FIG. **14** is a fragmentary, perspective view of a retention device suitable for use in the terminal of FIG. **1**A having features that are examples of aspects in accordance with the principles of the present disclosure.

FIG. **15** is an exploded, fragmentary, perspective view of the retention device of FIG. **14**.

FIG. **16** is a perspective view of a body of the retention device of FIG. **14**.

FIG. **17** is a perspective view of a cover piece for the retention device of FIG. **14**.

FIG. **18** is a perspective view of a fiber passage of the cover piece of FIG. **17**.

FIG. **19** is a fragmentary, perspective view of a boot suitable for use with the terminal of FIG. **1**A.

FIG. **20** is a schematic representation of an installation scheme for the terminal of FIG. **1**A.

FIG. **21** is a schematic representation of an installation scheme for the terminal of FIG. **1**A.

FIG. **22** is a schematic representation of an installation scheme for the terminal of FIG. **1**A.

FIG. **23** is a perspective view of an alternate embodiment of a retention device suitable for use with the terminal of FIG. **1**A having features that are examples of aspects in accordance with the principles of the present disclosure.

FIG. **24** is an exploded, fragmentary, perspective view of the retention device of FIG. **23**.

FIG. **25** is a perspective view of a protective boot suitable for use with the retention device of FIG. **23**.

FIG. **26** is an exploded, perspective view of a fiber optic connection system suitable for use in the terminal of FIG. **1**A.

DETAILED DESCRIPTION

Reference will now be made in detail to the exemplary aspects of the present disclosure that are illustrated in the accompanying drawings. Wherever possible, the same reference numbers will be used throughout the drawings to refer to the same or like structure.

Referring now to FIGS. **1**A-**1**C, a terminal, generally designated **10**, for mounting to a fiber distribution cable **12** is shown. The terminal **10** includes a housing, generally designated **14**, having a base, generally designated **16**, and a cover, generally designated **18**.

Referring now to FIGS. **1**A-**2**, the cover **18** includes an outer surface **20**, an oppositely disposed rear surface **22**, a top wall **24**, an oppositely disposed bottom wall **26**, and sidewalls **28**. The terminal **10** defines a footprint area that is defined by an outer perimeter **30** of the cover **18**. In the subject embodiment, the footprint area is defined by the top wall **24**, the bottom wall **26**, and the sidewalls **28**. In the subject embodiment, the footprint area is generally rectangular in shape. It will be understood, however, that the scope of the present disclosure is not limited to the cover having a footprint that is generally rectangular in shape. In the subject embodiment, and by way of example only, the footprint area of the terminal **10** is less than 25 in^2. In another embodiment, the footprint area of the terminal **10** is less than 21 in^2.

The outer surface **20** of the cover **18** includes a plurality of angled steps, generally designated **32**. In the subject embodiment, and by way of example only, there are four angled steps **32***a*, **32***b*, **32***c*, **32***d*. The angled steps **32** are configured on the outer surface **20** of the cover **18** in arcuate shaped rows. This arcuate row configuration efficiently utilizes space on the outer surface **20** of the cover **18** thereby allowing for a compact size of the terminal **10**.

Referring now to FIGS. **1**B, **1**C, **3**A and **3**B, each angled step **32** includes a plurality of mounting surfaces **34** on which are disposed adapters **36**. In the subject embodiment, and by way of example only, each angled step **32***a*, **32***b*, **32***c*, **32***d* includes three mounting surfaces **34***a*, **34***b*, **34***c*. Each mounting surface **34***a*, **34***b*, **34***c* is disposed on the angled step **32** such that each mounting surface **34***a*, **34***b*, **34***c* is oriented at an oblique angle γ (shown in FIG. **3**A) to the base **16** and forms a mating angle α (shown in FIG. **3**B) with each adjacent mounting surface **34***a*, **34***b*, **34***c* on the angled step **32**. The mating angle α is defined as the space between adjacent mounting surfaces **34** having a common edge with the adja-

cent mounting surfaces **34** diverging from each other. For example, in the subject embodiment, the mounting surface **34***a* of the angled step **32***a* shares a common edge **39** (shown only in FIG. **1**B) with the adjacent mounting surface **34***b*. The mounting surface **34***a* forms a mating angle α_1 with the mounting surface **34***b*. In the subject embodiment, the mating angle α_1, which is measured on the outer surface **20** of the cover **18**, is an oblique angle. In the subject embodiment, and by way of example only, the mating angle α_1 is less than about 210 degrees. In one embodiment, the mating angle α_1 is about 190 degrees. Similarly, the mounting surface **34***c* forms a mating angle α_2 with the mounting surface **34***b*. In the subject embodiment, the mating angle α_2 is an oblique angle. In the subject embodiment, and by way of example only, the mating angle α_2 is less than about 210 degrees. In one embodiment, the mating angle α_2 is about 190 degrees. The angling of each of the mounting surfaces **34** with respect to the base **16** and to the adjacent mounting surfaces **34** further efficiently utilizes the space of the outer surface **20** of the cover **18** thereby allowing for a compact size of the terminal **10**.

In the subject embodiment, the adapters **36** are oriented on each of the angled steps **32** such that one adapter **36** is disposed on each of the mounting surfaces **34** of each of the angled steps **32**. The adapters **36** are oriented on the mounting surfaces **34** such that the adapters **36** are generally perpendicular to the corresponding mounting surfaces **34**. The adapters **36** are oriented in an arcuate configuration on each of the angled steps **32**.

Referring now to FIGS. **4**, **5** and **26**, the adapters **36** include a first port **37** for receiving a connectorized end of a first cable having a first fiber optic connector **332** and a second port **38** for receiving a connectorized end of a second cable having a second fiber optic connector. The first cable is optically coupled to the second cable when the connectorized ends of the first and second cables are positioned within their respective ports **37**, **38** of the adapter **36**. The adapters **36** of the subject embodiment have been described in U.S. patent application Ser. No. 11/657,404 (now U.S. Pat. No. 7,591,595), which was filed on Jan. 24, 2007 and which is hereby incorporated by reference. It will be understood, however, that the scope of the present disclosure is not limited to the adapters **36** shown as the adapters **36** can be any of a variety of adapters **36** including, but not limited to SC, angled SC, dual SC (shown only in FIG. **5**), LC, dual LC, etc.

The first connector **332** and the adapter **36** are hardened or ruggedized. By hardened or ruggedized, it is meant that first connector **332** and the adapter **36** are adapted for outside environmental use. For example, the first connector **332** and the adapter **36** can include environmental seals for preventing moisture/water intrusion.

Referring to FIG. **26**, the first connector **332** includes a connector housing **339** including a main body **336** and a cover **341**. The connector housing **339** extends from a distal end to a proximal end (distal and proximal are defined with respect to the connection with the first fiber optic cable for connector **332**). A ferrule assembly **343** mounts adjacent the distal end of the connector housing **339** and a strain relief boot **342** mounts adjacent the proximal end of the connector housing **339**. A sealing member **349** (e.g., an o-ring seal) mounts around a periphery/exterior of the connector housing **339**. The sealing member **349** is adapted for providing a seal between the connector housing **339** and the adapter **36** when the first connector **332** is plugged into the first port **37** of the adapter **36**. The first connector **332** also includes a crimp band **338** that mounts over the main body **336** and the cover **341**, and a sealing tube **306** that seals the interface between the first cable and the connector housing **339**. The crimp band **338** assists in retaining the cover **341** on the main body **336** and also assists in securing strength members **324** of the first cable in place between the cover **341** and the main body **336**. The first connector **332** also includes first and second fastening structures for retaining (i.e., connecting, securing, etc.) the first connector **332** within the first port **37** of the adapter **36**. For example, the first connector **332** can include a latch **350** for mechanically interlocking with the adapter **36** when the first connector **332** is inserted in the first port **37**. The first connector **332** also includes a coupling nut **340** adapted to thread into the adapter **36** to retain the first connector **332** within the first port **37** of the adapter **36**.

The coupling nut **40** of the first connector **32** is adapted to provide a second connection mechanism for securing the first connector **32** to the adapter **34**. After the latch **50** has interlocked with the adapter **34**, the coupling nut **40** can be threaded into corresponding threads provided within the first port **35** so as to provide a second connection with the adapter **34**. The coupling nut **40** provides a connection with the adapter **34** that has a substantially greater pull-out resistance from the pull-out resistance provided by the latch **50**. In one example embodiment, the coupling nut **40** retains the first connector **32** in the first port **35** even if a pull-out force of at least 100 pounds is applied to the first connector **32**.

The coupling nut **340** of the first connector **332** includes a first region and a second region. The first region includes a plurality of grooves to facilitate grasping of the first region, such as by a field technician or other user during connection or disconnection of the connector **332** with the adapter **36**. The grooves are for example a plurality of longitudinally oriented grooves that enable a user to more easily rotate the coupling nut **340**. Turning of the coupling nut **340** enables a connection means of the second region to engage or disengage with the adapter **36**. In the illustrated embodiment shown in FIG. **26**, the second region includes a connection means of exterior screw threads adapted to mate with internal threads provided within the first port **37** of the adapter **36**. In another embodiment, other connection means may also be used.

The exterior of the connector housing **339** includes a circumferential groove for mounting the sealing member **349**. The exterior of the housing **339** also includes circumferential shoulders, against which the crimp band **338** can abut after assembly of the connector, and a circumferential shoulder.

After the cover **341** has been connected with the body **336** and the first cable, the crimp band **338** is slid over a part of the connector housing **339** and crimped in place to hold the cover **341** securely onto the body **336**. The sealing tube **306** is then slid over a portion of the crimp band **338** so as to cover the end of the first cable, the proximal end of the connector housing **339** and at least a portion of the crimp band **338**. Heat is then applied to the sealing tube **306** to cause the sealing tube **306** to shrink and tightly form around the adjacent portions of the connector housing **339**, the crimp band **338**, and the first cable, to seal connector from foreign substances. The sealing member **349** is then mounted with the groove about the connector housing **339** to complete the installation of connector **332** onto the first cable. The boot **342** retains the coupling nut **340** on the connector housing **339**.

Referring to FIGS. **4** and **26**, the adapter **36** of the fiber optic connection system includes an outer housing **344** having a first housing piece **345** that interconnects with a second housing piece **347**. The first housing piece **345** defines a first end of the outer housing **344** at which the first port **37** is located. The second housing piece **347** defines a second end of the outer housing **344** at which the second port **38** is located. An adapter assembly mounts within the outer hous-

ing **344**. The adapter **36** also includes a mounting ring or nut **346** that mounts around the exterior of the outer housing **344**.

The first housing piece **345** of the adapter **36** includes a first region separated from a second region by a shoulder. The first and second regions have generally cylindrical outer shapes and the shoulder provides a diameter reduction from the first region to the second region. The second region defines external threads located adjacent the shoulder. The external threads are sized to mate with corresponding internal threads **368** of the mounting nut **346** such that the mounting nut **346** can be threaded on the second region of the first housing piece **345**. The second region also includes a pair of oppositely positioned latches for use in securing the first housing piece **345** to the second housing piece **347**.

The first region defines the first port **37** of the adapter **36**. Internal threads are provided within the first region adjacent the first end of the housing **344**. The internal threads within the first port **37** are sized to threadingly receive the exterior screw threads of the coupling nut **340** when the coupling nut is threaded into the first port **37** to provide a secure connection between the first connector **332** and the adapter **36**.

The first housing piece **345** defines an annular sealing surface positioned inside the first housing piece **345** at a location adjacent to the internal threads. An angled diameter transition decreases the internal diameter of the first port **37** from the internal threads to the annular sealing surface. The annular sealing surface is preferably generally cylindrical and is adapted to engage the sealing member **349** of the first connector **332** when the first connector **332** is fully inserted within the first port **37**. The interface between the annular sealing surface and the sealing member **349** provides an internal environmental seal between the first connector **332** and the adapter **36**.

The fiber optic connection system preferably has a compact configuration adapted to provide relatively high circuit densities. In one embodiment, the diameter D**1** of the sealing member **349** and the diameter D**2** of the annular sealing surface each are less than or equal to 15 mm. In an alternate embodiment, the diameter D**1** of the sealing member **349** and the diameter D**2** of the annular sealing surface each are less than or equal to 12.5 mm. In another embodiment, the diameter D**1** of the sealing member **349** and the diameter D**2** of the annular sealing surface each are less than or equal to 10 mm.

As the footprint area of the terminal **10** decreases, the adapter density of the terminal **10** increases. In the present disclosure, adapter density is defined as the number of adapters **36** per footprint area of the terminal **10**. The adapter density can be simplified to the number of adapters per square inch. A terminal **10** having a high adapter density is desired as this provides a more efficient utilization of space than a terminal **10** having a lower adapter density. In the subject embodiment, and by way of example only, adapter density is greater than or equal to about 12 adapters per 25 in^2, or 0.48 adapters/in^2. In another embodiment, and by way of example only, the adapter density is greater than or equal to about 12 adapters per 21 in^2, or 0.57 adapters/in^2. In the embodiment shown in FIG. **5** where dual SC adapters are used, the adapter density, by way of example only, is greater than or equal to about 24 adapters per 25 in^2, or 0.96 adapters/in^2. In another embodiment where dual SC adapters are used, the adapter density, by way of example only, is greater than or equal to about 1.14 adapters/in^2.

Referring now to FIG. **2**, the top and bottom walls **24**, **26** and the sidewalls **28** define an interior cavity **40**. The interior cavity **40** includes an open end **42** disposed on the rear surface **22** of the cover **18**.

The bottom wall **26** of the cover **18** includes a tail piece **44** that extends outwardly from the bottom wall **26**. In the subject embodiment, the tail piece **44** extends outwardly in a direction that is generally perpendicular to the bottom wall **26**. The tail piece **44** defines a longitudinal axis **46** (shown as a dashed line in FIG. **2**). The tail piece **44** further defines a cable opening **48** that extends through the tail piece **44** along the longitudinal axis **46** such that the cable opening **48** is in communication with the interior cavity **40**.

Referring now to FIGS. **2**, **6** and **7**, an anchor block, generally designated **50**, for use in mechanically securing the fiber distribution cable **12** to the housing **14** will be described. The anchor block **50** includes a main body **52** that extends from a first end **54** to a second end **56** of the anchor block **50**. The main body **52** is elongated along a center axis **58** (shown as a dashed line in FIG. **6**) of the anchor block **50**. The main body **52** of the anchor block **50** is configured to mechanically interlock with the cover **18** of the terminal **10**. In the subject embodiment, and by way of example only, the main body **52** includes first and second interlocking tabs **60**, **62** that project outwardly from the main body **52** in opposite directions relative to the center axis **58**. The first and second interlocking tabs **60**, **62** are configured to be received within corresponding first and second interlock receptacles provided within the interior cavity **40** of the cover **18** adjacent to the bottom end **26**. When the first and second interlocking tabs **60**, **62** are inserted into the corresponding first and second interlock receptacles, interference between the first and second interlocking tabs **60**, **62** and the structure forming the corresponding first and second interlock receptacles resists movement of the anchor block **50** in a direction along the center axis **58**.

With the first and second interlocking tabs **60**, **62** disposed in the corresponding first and second interlock receptacles, the first end **54** of the anchor block **50** is disposed in the interior cavity **40** of the cover **18** while the second end **56** of the anchor block **50** is disposed in the cable opening **48** of the tail piece **44**. In one embodiment, and by way of example only, the length of the anchor block **50** disposed in the cable opening **48** of the tail piece **44** is greater than 25%. In another embodiment, and by way of example only, the length of the anchor block **50** disposed in the cable opening **48** of the tail piece **44** is greater than 50%. In another embodiment, the length of the anchor block disposed in the cable opening **48** of the tail piece **44** is in the range of 25% to 50%.

The anchor block **50** also includes structure for securing the fiber distribution cable **12** to the main body **52**. In the subject embodiment, and by way of example only, the second end **56** includes a central groove **64** for receiving a central buffer tube of the fiber distribution cable **12**. The second end **56** also includes two side grooves **66** that are generally parallel to the central groove **64** and positioned on opposite sides of the central groove **64**. The side grooves **66** are sized to receive strength members of the fiber distribution cable **12**. By placing the strength members in the side grooves **66** and the central buffer tube in the central groove **64**, and then applying a securing material (e.g., adhesive such as epoxy) to the central groove **64** and the side grooves **66**, the fiber distribution cable **12** is secured to the anchor block **50**.

The anchor block **50** also includes a fan-out portion, generally designated **68**, that fans-out/spreads-apart optical fibers of the fiber distribution cable **12** that are routed and managed within the interior cavity **40** of the cover **18**. In the subject embodiment, and by way of example only, the anchor block **50** includes a fan-out channel **70** that extends from the central groove **64** to the first end **54** of the main body **52** of the anchor block **50**. The fan-out channel **70** has a width W_1 that

gradually widens as the fan-out channel **70** extends along the center axis **58** from the central groove **64** to the first end **54** of the anchor block **50**.

A divider **72** (see FIG. **7**) is located within the fan-out channel **70** at the first end **54** of the anchor block **50**. The divider **72** includes a plurality of openings **74** that individually receive the optical fibers to maintain separation of the optical fibers. In practice, the optical fibers extend from the end of the central buffer tube through the fan-out channel **70** to the divider **72**. At the divider **72**, the optical fibers each extend through one of the openings **74** of the divider **72**. The tapered configuration of the fan-out channel **70** allows the optical fibers to spread apart as the optical fibers extend from the end of the central buffer tube at the central groove **64** to the divider **72**. A securing material (e.g., an adhesive such as epoxy) can be used to fill the fan-out channel **70** after the optical fibers have been positioned therein to maintain position of the optical fibers.

Referring now to FIGS. **2** and **8**, a cable seal, generally designated **76**, for sealing the fiber distribution cable **12** in the tail piece **44** of the cover **18** is shown. In the subject embodiment, the cable seal **76** is made of an elastic material such as rubber. The cable seal **76** includes a first surface **78**, an oppositely disposed second surface **80** and a plurality of side surfaces **82**. In the subject embodiment, the cable seal **76** further includes a plurality of chamfers **84** that are located between the first surface **78** and each of the side surfaces **82**.

The cable seal **76** defines a cable entry hole **86** that extends through the cable seal **76**. In the subject embodiment, the cable entry hole **86** extends through the cable seal **76** in a direction that is generally perpendicular to the first surface **78**. The cable entry hole **86** is sized to receive and sealing engage the fiber distribution cable **12**. In the subject embodiment, the cable entry hole **86** is generally shaped as an elongated circle in order to conform to the fiber distribution cable **12**. It will be understood, however, that the scope of the present disclosure is not limited to the cable entry hole **86** being shaped as an elongated circle.

The cable seal **76** is configured to be inserted into the cable opening **48** of the tail piece **44**. In the subject embodiment, the cable seal **76** is inserted into the cable opening **48** such that the first surface **78** faces the interior cavity **40** of the cover. The chamfers **84**, which are disposed between the first surface **78** and each of the side surfaces **82**, ease the insertion of the cable seal **76** in the cable opening **48**. When inserted into the cable opening **48**, the side surfaces **82** of the cable seal **76** are in sealing engagement with the tail piece **44**. Thus, the cable seal **76** provides sealing engagement between the cable opening **48** of the tail piece **44** and the fiber distribution cable **12**.

Referring now to FIG. **9**, an alternate embodiment of the terminal **10** will be described. In the subject embodiment, the terminal **10** includes the base **16** and the cover **18**. The base **16** is adapted for snap-fit engagement with the cover **18** through a latch **88**, which is disposed on each longitudinal side **90** of the base, having a plurality of openings **92** adapted for engagement with a plurality of protrusions **94** disposed on each of the sidewalls **28** of the cover **18**. In this alternate embodiment, the terminal **10** further includes a fiber routing tray, generally designated **96**.

Referring now to FIGS. **9-12**, the fiber routing tray **96** includes a top panel **98**, a bottom panel **100**, and first and second side panels **102***a*, **102***b* disposed about the periphery of the top and bottom panels **98**, **100** (directional references such as top and bottom are made with regard to FIG. **10**). In the subject embodiment, the top panel **98** is disposed above the bottom panel **100** such that the top and bottom panels **98**, **100** define a storage space **104** (best shown in FIG. **12**) between the top and bottom panels **98**, **100**. The first side panel **102***a* is in connected engagement with both of the top and bottom panels **98**, **100** while the second side panel **102***b* is in connected engagement with the bottom panel **100**. In the subject embodiment, each of the first and second side panels **102***a*, **102***b* extend between the top and bottom panels **98**, **100** in a direction that is generally perpendicular to the top and bottom panels **98**, **100**. It will be understood, however, that the scope of the present disclosure is not limited to the first and second side panels **102***a*, **102***b* extending between the top and bottom panels **98**, **100** in a direction that is generally perpendicular.

The bottom panel **100** includes a plurality mounting holes **106**. The mounting holes **106** are sized to receive mounting pins **108** (shown in FIG. **9**) disposed in the interior cavity **40** of the cover **18**. In the subject embodiment, and by way of example only, there are four mounting holes **106** disposed in the bottom panel **100** with two mounting holes **106** disposed at a first end portion **110** of the bottom panel **100** and two mounting holes disposed at a bottom end portion **112**. The engagement of the mounting holes **106** and the mounting pins **108** provide for proper alignment and retention of the fiber routing tray **96** in the interior cavity **40** of the cover **18**.

In the subject embodiment, the top panel **98** also includes a plurality of holes **113** adapted to receive the mounting pins **108** disposed in the interior cavity **40** of the cover **18**. In the subject embodiment, and by way of example only, there are two holes **113** disposed on the top panel **98** so as to be in alignment with the mounting holes **106** disposed on the bottom panel **100** at the bottom end portion **112**.

In the subject embodiment, the bottom panel **100** further includes a ramp portion **114** disposed at the bottom end portion **112** of the bottom panel **100**. The ramp portion **114** is disposed at an angle β with respect to the bottom end portion **112** of the bottom panel **100**. In the subject embodiment, and by way of example only, the ramp portion **114** is disposed at an angle that is less than or equal to 45 degrees from the bottom end portion **112** of the bottom panel **100**. The ramp portion **114** provides a location for optical fibers **124** disposed in the interior cavity **40** of the cover **18** and engaged with the adapters **36** to enter the storage space **104** of the fiber routing tray **96**.

In the subject embodiment, the fiber routing tray **96** is a continuous piece of material. To assembly the fiber routing tray **96**, the second side panel **102***b* is bent at a first fold **116**, which is disposed between the bottom panel **100** and the second side panel **102***b*, such that the second side panel **102***b* is generally perpendicular to the bottom panel **100**. The first side panel **102***a* is bent at a second fold **118** disposed between the bottom panel **100** and the first side panel **102***a* such that the first side panel **102***a* is generally perpendicular to the bottom panel **100**. The top panel **98** is bent at a third fold **120** disposed between the top panel **98** and the first side panel **102***a* such that the top panel **98** is generally perpendicular to the first side panel **102***a*. The ramp portion **114** is bent at a forth fold **122** disposed between the ramp portion **114** and the bottom end portion **112** of the bottom panel **100** such that the ramp portion **114** is disposed at an angle β with respect to the bottom end portion **112** of the bottom panel **100**.

Referring now to FIG. **13**, a cable routing schematic for the terminal **10** with the fiber routing tray **96** is shown. In the subject embodiment, optical fibers **124** that are engaged with the adapters **36** are routed into the storage space **104** of the fiber routing tray **96** through the ramp portion **114** of the bottom panel **100**. In a preferred embodiment, the optical fibers **124** are bend insensitive fibers. An exemplary bend insensitive fiber is BendBright XS produced by Draka

Comteq. It will be understood, however, that the scope of the present disclosure is not limited to BendBright XS fiber as various bend insensitive fibers could be used. Exemplary disclosures of bend insensitive fibers include U.S. Pat. Nos. 4,838,643 and 5,278,931, both of which are hereby incorporated by reference. In the event that bend insensitive fibers are not used, bend radius protectors may be installed to prevent attenuation of the optical fibers **124**.

The optical fibers **124** are routed from the ramp portion **114** of the bottom panel **100** through a passage **126** defined between one of the mounting pins **108** and the adjacent sidewall **28** (shown as a dashed line in FIG. **13**) of the cover **18**. The optical fibers **124** are then loosely coiled in the storage space **104** such that the coils of optical fibers **124** are interiorly disposed with respect to the mounting pins **108**.

The optical fibers **124** are in connected engagement with a fan-out device **128** that combines the individual optical fibers **124** into a multi-fiber optic cable **130**. The multi-fiber optic cable **130** then exits the storage space **104** of the fiber routing tray **96** and the interior cavity **40** of the cover **18** through the cable opening **48** of the tail piece **44**.

In the subject embodiment, a multi-fiber splice **132** connects the multi-fiber optic cable **130** to the fiber distribution cable **12**. In order to assist in splicing the multi-fiber optic cable **130** to the fiber distribution cable **12**, the multi-fiber optic cable **130** can be pulled from the storage space **104** of the fiber routing tray **96** through the cable opening **48** of the tail piece **44** of the cover **18**. The loosely coiled arrangement of optical fibers **124** in the storage space **104** of the fiber routing tray **96** allows for the multi-fiber optic cable **130** to be pulled from the storage space **104** without having to disassemble the housing **14**. This is advantageous as it does not disrupt or create any potential disruption of the connections between the pre-assembled optical fibers **124** and the adapters **36**. While the multi-fiber optic cable **130** can be pulled from the terminal **10**, the multi-fiber optic cable **130** is protected from being pulled too far out of the tail piece **44** by the routing of the optical fibers **124** through the passage **126**, which is disposed between one of the mounting pins **108** and the adjacent sidewall **28** of the cover **18**. In the event that the multi-fiber optic cable **130** is pulled beyond a given length stored in the storage space **104** of the fiber routing tray **96**, the optical fibers **124** will rap around the mounting pin **108** thereby providing resistance which will notify the installer that the storage limit has been reached.

Referring now to FIG. **14**, a retention device, generally designated **134**, for securing the fiber distribution cable **12** to the terminal **10** after splicing the fiber distribution cable **12** to the multi-fiber optic cable **130** will be described. The retention device **134** is connectedly engaged with the tailpiece **44** of the cover **18** of the housing **14** such that the retention device **134** extends outwardly from the tail piece **44**. In the subject embodiment, the retention device **134** extends outwardly from the tail piece **44** in a direction that is generally perpendicular to the bottom wall **26** of the cover **18**.

Referring now to FIG. **15**, the retention device **134** includes a base piece, generally designated **136**, a body, generally designated **138**, and a cover piece, generally designated **140**. In the subject embodiment, the base piece **136** is an integral part of the tail piece **44** of the cover **18**. It will be understood, however, that the scope of the present disclosure is not limited to the base piece **136** being integral with the tail piece **44**. The base piece **136** includes longitudinal sidewalls **142** with each longitudinal sidewall **142** having a catch **144**. The base piece **136** defines longitudinal slots **146**. In the subject embodiment, and by way of example only, there are two longitudinal slots **146**. The longitudinal slots **146** are oriented in the base piece **136** so as to be generally parallel to the center axis **58** of the tail piece **44**. It will be understood, however, that the scope of the present disclosure is not limited to the longitudinal slots **146** being generally parallel to the center axis **58** of the tail piece **44**.

Referring now to FIG. **16**, the body **138** of the retention device **134** will be described. The body **138** includes a lower surface **148**, an oppositely disposed upper surface **150**, a front side **152**, a back side **154**, and longitudinal sides **156** (directional references such as upper, lower, front and back are relative to FIG. **16**). The body **138** further includes a central axis **158** that is centrally disposed in the body **138**.

The lower surface **148** includes longitudinal protrusions **160** that extend downwardly from the lower surface **148** in a direction that is generally perpendicular to the lower surface **148**. The longitudinal protrusions **152** are configured to be received in the longitudinal slots **146** of the base piece **136** in order to aid in the retention of the body **138** in the base piece **136**.

The upper surface **150** defines a fiber passage, generally designated **161**. The fiber passage **161** includes a cable jacket cavity **162** disposed near the front side **152** of the body **138**. The cable jacket cavity **162** is adapted to receive the cable jacket of the fiber distribution cable **12**. In one embodiment, the cable jacket cavity **162** includes a plurality of grasping protrusions that extend outwardly from the cable jacket cavity **162**. The grasping protrusions aid in the retention of the fiber distribution cable **12** in the retention device **134**.

The fiber passage **161** further includes a first center groove **164** disposed adjacent to the cable jacket cavity **162**. In the subject embodiment, the first center groove **164** is aligned with the central axis **158** of the body **138**. In the subject embodiment, the first center groove **164** is adapted to receive a buffer tube of the fiber distribution cable **12**. Disposed on either side of the first center groove **164** are side grooves **166**. In the subject embodiment, the side grooves **166** are generally parallel to the first center groove **164**. The side grooves **166** are adapted to receive strength members of the fiber distribution cable **12**.

The fiber passage **161** defined by the upper surface **150** of the body **138** further includes a recess **168** disposed adjacent to the first center groove **164** and the side grooves **166**. The recess **168** is the dividing line between the fiber distribution cable **12** and the multi-fiber optic cable **130**. The recess **168** is adapted to receive the multi-fiber splice **132** that optically couples the optical fibers of the fiber distribution cable **12** and the multi-fiber optic cable **130** and a crimp that couples and retains the strength members of the fiber distribution cable **12** to strength members in the multi-fiber optic cable **130**.

The fiber passage **161** also includes a second center groove **170** that extends from the recess **168** through the back side **154** of the body **138**. In the subject embodiment, the second center groove **170** is aligned with the central axis **158** of the body **138**. In the subject embodiment, the second center groove **170** is adapted to receive a buffer tube of the multi-fiber optic cable **130**. Disposed on either side of the second center groove **170** are grooves **172**. In the subject embodiment, the grooves **172** are generally parallel to the second center groove **170**. The grooves **172** are adapted to receive strength members of the multi-fiber optic cable **130**.

In the subject embodiment, a plurality of adhesive recesses **174** is defined by the upper surface **150** of the body **138**. In the subject embodiment, and by way of example only, there are two adhesive recesses **174** with one adhesive recess **174** disposed on each side of the fiber passage **161**. The adhesive recesses **174** provide a receptacle for adhesive (such as epoxy, etc.). The adhesive can be used to secure the fiber distribution

cable **12** and the multi-fiber optic cable **130** in the retention device **134**. The type of adhesive used in the adhesive recesses **174** will affect the force required to remove the fiber distribution cable **12** and the multi-fiber optic cable **130** by pulling on the cables (pull-out force). Each adhesive recess **174** defines a plurality of adhesive passages **176** that provide communication between the adhesive recess **174** and the fiber passage **161**. The adhesive passages **176** allow for adhesive that is poured into the adhesive recesses **174** to flow into the fiber passage **161**.

In the subject embodiment, each of the longitudinal sides **156** of the body **138** defines a latch groove **178**. In the subject embodiment, and by way of example only, there are two latch grooves **178** disposed on each longitudinal side **156**.

Referring now to FIGS. **17** and **18**, the cover piece **140** will be described. The cover piece **140** includes a top surface **180**, a bottom surface **182**, a tail-piece end **184**, and a distribution cable end **186** (directional references such as top and bottom are relative to FIG. **14**). The tail-piece end **184** includes a retention protrusion, generally designated **188**, having a body portion **190** and a retention portion **192**. In the subject embodiment, the body portion **190** of the retention protrusion **188** extends outwardly from the top surface **180** in a direction that is generally perpendicular to the top surface **180**. It will be understood, however, that the scope of the present disclosure is not limited to the body portion **190** of the retention protrusion **188** extending outwardly in a direction that is generally perpendicular to the top surface **180**.

The retention portion **192** of the retention protrusion **188** extends outwardly from the body portion **190** and defines a retention groove **194**. The retention groove **194** extends along the length of the retention portion **192** such that the retention groove **194** is generally transverse to a central longitudinal axis **196** defined by the cover piece **140**. In the subject embodiment, the retention protrusion **188** is hook-shaped. This configuration allows the retention protrusion **188** to receive a lip **198** (shown on FIG. **15**) disposed around the tail piece **44** of the cover **18** for laterally retaining the retention device **134** to the cover **18**.

The bottom surface **182** of the cover piece **140** defines a cable passage, generally designated **200**. The cable passage **200** includes a jacket cavity **202**, a first cable recess **204** disposed adjacent to the jacket cavity **202** and aligned generally with the central longitudinal axis **196**, a strength groove **206** disposed on either side of the first cable recess **204** and disposed generally parallel to the central longitudinal axis **196**, a crimp recess **208** disposed adjacent to the first cable recess **204**, a second cable recess **210** that extends from the crimp recess **208** through the back side **186** of the cover piece and is generally aligned with the central longitudinal axis **196**, and a strength member groove **212** disposed on either side of the second cable recess **210**.

The cavities and recesses defined on the bottom surface **182** of the cover piece **140** are oriented on the bottom surface **182** so that the cavities and recesses are aligned with the cavities and recesses defined on the upper surface **150** of the body **138** when the body **138** and the cover **140** are engaged.

The cover **140** further includes a plurality of resilient latches, generally designated **214**. In the subject embodiment, and by way of example only, there are four resilient latches **214** with two resilient latches **214** disposed on each side **216** of the cover piece **140**. Each of the resilient latches **214** includes a base end **218** and an oppositely disposed free end **220**. The base end **218** is in connected engagement with the side **216**. The free end **220** of the resilient latch **214** extends outwardly from the side **216** in a direction that is generally perpendicular to an outer edge **222** of the side **216**. In the subject embodiment, the base end **218** of the resilient latch **214** is integral with the side **216**. The free end **220** includes a lip protrusion **224** and a sloped surface **226**.

Referring now to FIG. **15-18**, the body **138** of the retention device **134** is inserted into the base piece **136** such that the longitudinal slots **146** receive the longitudinal protrusions **160**. With the body **138** engaged with the base piece **136**, the multi-fiber splice **132**, which connects the fiber distribution cable **12** and the multi-fiber optic cable **130**, is inserted into the recess **168** of the body **138** of the retention device **134**. The multi-fiber splice **132** is inserted into the recess **168** such that the cable jacket, the buffer tube, and strength members of the fiber distribution cable **12** are inserted into the cable jacket cavity **162**, the first center groove **164** and the side grooves **166**, respectively, and the buffer tube and the strength members of the multi-fiber optic cable **130** are inserted into the second center groove **164** and the grooves **172**, respectively. With the multi-fiber splice **132** properly inserted into the body **138**, the cover piece **140** is engaged with the base piece **136** such that the fiber distribution cable **12** and the multi-fiber optic cable **130** are disposed in the fiber passage **200** of the bottom surface **182** of the cover piece **140**. The cover piece **140** is then pressed toward the base piece **136** such that the resilient latches **214** of the cover piece **140** engage the catches **144** of the base piece **136**. Epoxy can be added to the body **138** and/or the cover piece **140** prior to the engagement of the cover piece with the base piece **136** in order to secure the fiber distribution cable **12** in the retention device **134**.

Referring now to FIG. **19**, a boot **228** is molded over the retention device **134** and the tail piece **44** of the cover **18** following the installation of the fiber distribution cable **12** and the multi-fiber optic cable **130** in the retention device **134**. In the subject embodiment, the boot **228** includes a plurality of strain relief grooves **230** disposed near a cable end **232** of the boot **228**.

Referring now to FIGS. **20-21**, a method for installing the terminal **10** will be described. The multi-fiber optic cable **130** is pulled from the interior cavity **40** through the tail end **44** of the housing **14**. In the subject embodiment, the multi-fiber optic cable **130** is then spliced to the fiber distribution cable **12** with a multi-fiber splice **132**.

With the multi-fiber optic cable **130** spliced to the fiber distribution cable **12**, the multi-fiber optic cable **130** is inserted back into the interior cavity **40** of the housing **14** through the tail end **44** of the cover **18**. A spliced end of the multi-fiber optic cable **130**, the multi-fiber splice **132**, and a spliced end of the fiber distribution cable **12** are then inserted into the body **138** of the retention device **134**. In one embodiment, epoxy is installed in the adhesive recesses **174** of the body **138** to secure the fiber distribution cable **12** in the retention device **134**. The cover piece **140** is then inserted over the body **138** of the retention device **134** such that the resilient latches **214** of the cover piece **140** engage the catches **144** of the base piece **136**.

Referring now to FIG. **22**, with the retention device **134** securing the fiber distribution cable **12** to the housing **14**, the boot **228** is molded over the retention device **134** to prevent dust, rain, snow, or ice from entering the terminal **10**. The boot **228** is molded over a portion of the tail end **44** of the cover **18**, the retention device **134** and an end portion of the fiber distribution cable **12**.

Referring now to FIG. **23**, an alternate embodiment of a retention device **400** is shown. The retention device **400** includes the base piece **136**, a body **402**, and a cover piece **404**. In the subject embodiment, the body **402** and the cover piece **404** are similar to the body **138** and the cover piece **140** described with regard to the retention device **134**. However, in

the alternate embodiment of the retention device **400**, each of the body **402** and the cover piece **404** include a grounding opening **405** (shown in FIG. **24**) that is adapted to receive a grounding lug assembly, generally designated **406**. The grounding opening **405** is defined near fiber distribution cable ends **407** (shown in FIG. **24**) of the body **402** and the cover piece **404**. In the subject embodiment, the grounding opening **405** extends through a cable jacket recess **409** defined at the fiber distribution cable ends **407** of the body **402** and the cover piece **404**. A plurality of embodiments of the grounding lug assembly **406** has been provided in U.S. patent application Ser. No. 11/157,561 (now U.S. Pat. No. 7,492,996), which was filed on Jun. 21, 2005 and is hereby incorporated by reference.

Referring now to FIG. **24**, the grounding lug assembly **406** includes a lug **408**, a compression insert **410**, and a nut **412**. The lug **408** includes a first axial end portion **414** and a second axial end portion **416**. In the subject embodiment, the first axial end portion **414** is bifurcated with external threads **418**, which are adapted to engage with the nut **412**, disposed on an outer surface of the first axial end portion **414**. The first axial end portion **414** defines a cable slot **420** which is adapted to receive cable sheathing **422** that covers the fiber distribution cable **12**. In the subject embodiment, cable sheathing **422** (or cable armor) is a sheathing that is made of steel or aluminum.

In the subject embodiment, the second axial end portion **416** of the lug **408** includes a plurality of threads **423** disposed on an outer surface of the second axial end portion **416**. The plurality of threads **423** is adapted to threadedly engage internal threads disposed on a grounding nut **424**. The second axial end portion **416** is adapted to engage a grounding wire (such as a #6 wire).

The compression insert **410** includes an upper portion **425** having curved end surfaces **426**. The upper portion **425** fits within the nut **412** and has a slightly smaller diameter than the curvature of the external threads **418** on the first axial end portion **414** so as not to interfere with advancement of the nut **412** along the external threads **418**.

The compression insert **410** further includes a lower portion **428** having a nut engaging surface **430** and a cable engaging surface **432**. The nut engaging surface **430** includes a plurality of nut engaging tabs **434** that are configured for engaging the nut **412** as it advances along the external threads **418** of the first axial end portion **414**.

The cable engaging surface **432** defines a cable recess **436** having a pair of shoulders **438** disposed along the cable recess **436**. The cable recess **4** is adapted for receiving the cable sheathing **422** of the fiber distribution cable **12**. The shoulders **438** are adapted to engage corresponding shoulders **440** disposed in the cable slot **420**. The engagement of the shoulders **438** and the corresponding shoulders **440** prevents over compression of the fiber distribution cable **12**, which might lead to damage of the optical fibers within the fiber distribution cable **12**.

Referring now to FIG. **25**, an alternate embodiment of a protective boot **442** is shown. The protective boot **442** is molded over the retention device **400**, a portion of the tail piece **44** of the cover **18**, and a portion of the grounding lug assembly **406** following the installation of the fiber distribution cable **12** and the multi-fiber optic cable **130** in the retention device **400**. The protective boot **442** includes a plurality of strain relief grooves **444** disposed near a cable end **446** of the protective boot **442**.

In the subject embodiment, the second axial end portion **416** and the grounding nut **425** are not over molded by the protective boot **442**. This exposure of the second axial end portion **416** and the grounding nut **425** allows the cable sheathing **422** to be grounded by a grounding wire.

Various modifications and alterations of this disclosure will become apparent to those skilled in the art without departing from the scope and spirit of this disclosure, and it should be understood that the scope of this disclosure is not to be unduly limited to the illustrative embodiments set forth herein.

What is claimed is:

1. A terminal for mounting to a fiber distribution cable, comprising

a housing including:

a base; and

a cover connectedly engaged with the base, the cover and the base defining an interior cavity; and

a plurality of adapters adapted for outside environmental use disposed on the cover, each of the plurality of adapters including a first port for receiving a first fiber optic connector from outside the housing and a second port for receiving a second fiber optic connector from inside the housing, wherein the first ports are sealed to prevent moisture or water intrusion into the interior cavity of the housing, and wherein each of the first ports includes internal threads adapted to mate with corresponding threads of the first fiber optic connectors;

wherein the terminal has an adapter density that is greater than or equal to 0.48 adapters/in^2.

2. The terminal of claim **1**, wherein the terminal has an adapter density that is greater than or equal to 0.57 adapters/in^2.

3. The terminal of claim **1**, wherein the terminal has an adapter density that is greater than or equal to 0.96 adapters/in^2.

4. The terminal of claim **1**, wherein the terminal has an adapter density that is greater than or equal to 1.14 adapters/in^2.

5. The terminal of claim **1**, wherein the cover includes a plurality of angled steps with each angled step defining a plurality of mounting surfaces, and wherein adapters of the plurality of adapters are disposed on each of the angled steps such that one adapter is disposed on each mounting surface.

6. The terminal of claim **5**, wherein the angled steps are configured on an outer surface of the cover in arcuate shaped rows.

7. The terminal of claim **5**, wherein each angled step forms an oblique angle with the base and each mounting surface forms an oblique mating angle with an adjacent mounting surface on the angles step.

8. The terminal of claim **5**, wherein the adapters being arcuately oriented on each of the angles steps.

9. The terminal of claim **1**, wherein at least one of the plurality of adapters include an outer housing having a first end and a second end, wherein the first end is the first port having internal threads adapted to receive exterior threads of the first fiber optic connector.

10. The terminal of claim **9**, wherein the outer housing of at least one of the plurality of adapters defines a sealing surface positioned inside the outer housing, the sealing surface being adapted to engage a sealing member of the first fiber

optic connector when the first fiber optic connector is inserted within the first port.

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